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# FIRST REPORT

OF THE

# BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY

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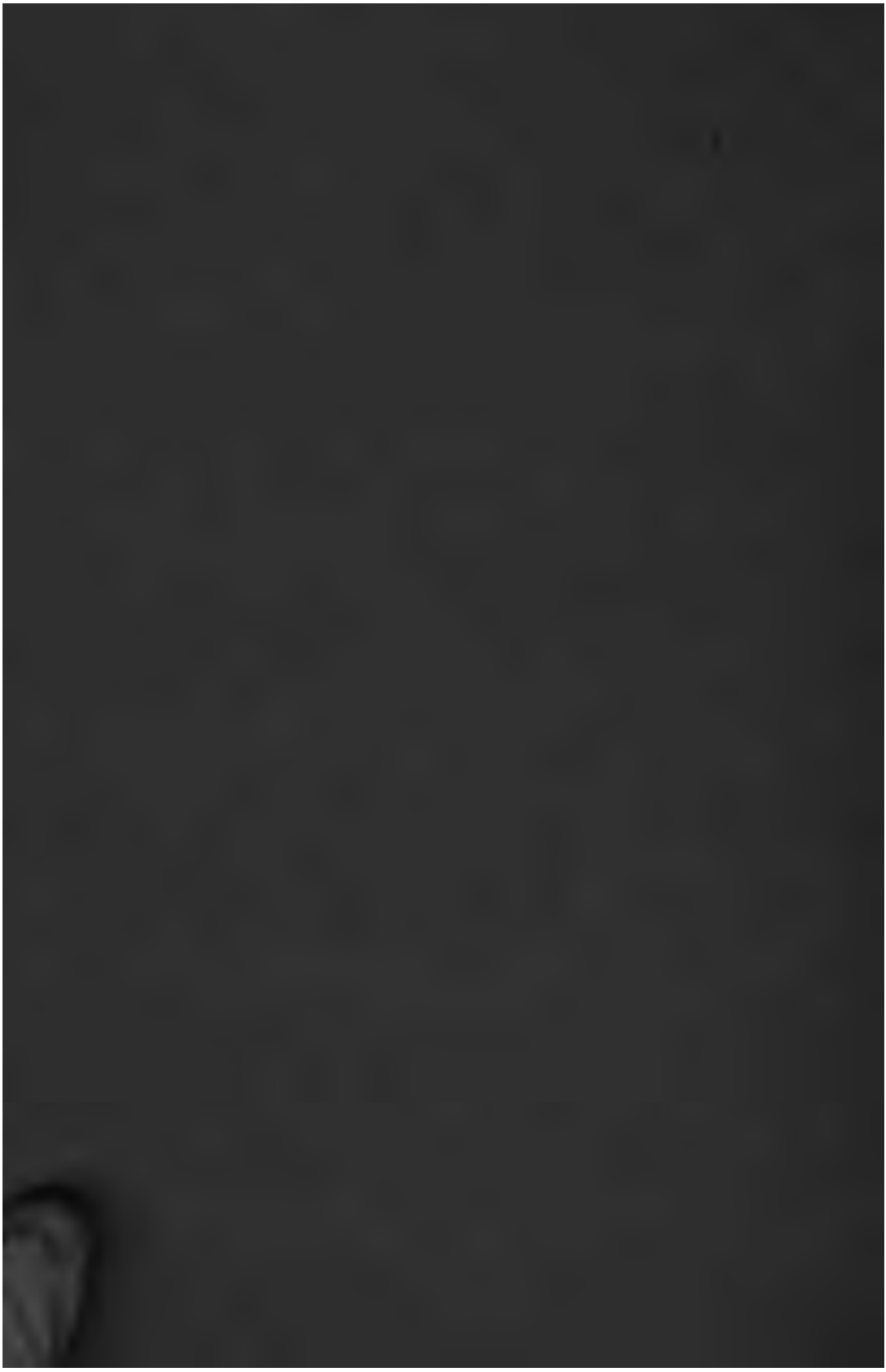

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# FIRST REPORT

OF THE

# BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY

OF THE

# TERRITORY OF HAWAII.

For the period from
JULY 1, 1903, TO DECEMBER 31, 1904

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# FORESTRY.

To the Legislature of the Territory of Hawaii:

The Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii hereby makes report of the status and acts of this Board since its appointment, to December 31st, 1904.

## ORGANIZATION OF BOARD.

The law under which the Board is organized is Act 44 of the Territorial laws of 1903, approved April 25th, 1903.

Under its provisions, Governor Dole, on the 13th day of May, 1903, appointed W. M. Giffard, A. W. Carter, James D. Dole, J. F. Brown and L. A. Thurston as Commissioners. The Superintendent of Public Works is ex-officio a member and executive officer of the Board.

On May 18, 1903, the Board organized by electing L. A. Thurston President, and Henry E. Cooper, Superintendent of Public Works, as Secretary. Upon the resignation of Henry E. Cooper, his successor, C. S. Holloway, was elected Secretary.

The Board later sub-divided itself into committees, as follows, viz.:

*Forestry and Nursery*—Messrs. L. A. Thurston, W. M. Giffard and A. W. Carter.

*Entomology*—Messrs. W. M. Giffard and J. F. Brown.

*Finance*—Messrs. C. S. Holloway and W. M. Giffard.

*Rules and Regulations*—Messrs. L. A. Thurston and A. W. Carter.

*Agriculture*—Messrs. Jas. D. Dole and J. F. Brown.

Under the statute one of the Commissioners retires on the first of January of each year.

The commission of L. A. Thurston having expired, he was reappointed January 1, 1905.

Each of the principal matters coming before the Board is referred to the appropriate committee and consideration thereof and report thereon made by such committee. In addition to the committee meetings the Board has held fifty-two meetings, and two public hearings relating to proposed forest reserves.

### HEADQUARTERS OF BOARD.

Upon the organization of the Board it found itself quartered in two rooms in the basement of the Executive Building, dark, stuffy and entirely inadequate in every way.

The corrugated iron building at the government nursery on King street, theretofore used as laborers' quarters, and for fumigation and storage purposes, was floored, ceiled and painted by Henry De Fries at an expense of $4,264 and converted into comfortable quarters, ample for the present for all the purposes of the Board. It includes a museum room for showing collections of woods and fruits; a library in which meetings of the Board and other meetings are held; offices for the Superintendent of Forestry and Superintendent of Entomology; Entomologist's laboratory, insect breeding-room, store-room and office of clerk and stenographer.

This building was occupied by the Board in February, 1904. It is only ten minutes distant, by street car, from the center of the city, and, being situate in the large yard constituting the nursery, is admirably located and adapted to its uses.

### POWERS AND DUTIES OF BOARD.

The statute creating the Board devolves upon it the execution of all existing statutes relating to the subjects coming within its jurisdiction, and specifically enumerates the following duties:

(1) To gather, compile and publish information and statistics concerning forestry, entomology, plant pathology and general agriculture and to establish a library of publications germane to the subjects covered by the act;

(2) To co-operate with other organizations doing work coming within the scope of the subject matter of the act, more particularly the Federal Agricultural Experiment Station, avoiding as far as practicable, duplication of their work;

(3) To make rules and regulations, subject to the approval of the Governor, in connection with the subject matters of the act;

(4) To appoint a Superintendent of Forestry, District Foresters, Assistant Foresters and Forest Rangers;

(5) To have the care and control of forest reserves;

(6) To devise ways and means for protecting and making available springs, streams and other sources of water supply;

(7) To devise ways and means for making forest reserves self-supporting;

(8) To secure the fencing of forest reserves and exclusion of stock therefrom;

(9) To appoint a Superintendent of Entomology and Assistants thereto;

(10) To provide building and apparatus for quarantine and disinfection of fruits and plants and for the obtaining and distribution of beneficial insects;

(11) To supervise and direct all officers and all expenditures authorized by the act;

(12) To formulate and recommend additional legislation;

(13) To make annual reports of the proceedings and expenditures of the Board.

*Sub-Division of Powers and Duties.*

These powers and duties naturally divide themselves into the following sub-divisions, viz.:

1. General Objects, Powers and Duties;
2. Matters appertaining to Forestry;
3. Matters appertaining to Entomology;
4. Matters appertaining to Agriculture.

For purposes of greater clearness these subjects are treated in the order named.

## GENERAL OBJECTS, POWERS AND DUTIES.

### LIBRARY.

A library has been established, relating to the subject matters enumerated in the act, which now contains approximately 2,848 books, pamphlets and magazines on Agriculture, Forestry and general subjects, and 494 on Entomology, a total of 3,342. In addition to this the Hawaiian Stock Breeders' Association has deposited with the Board its library of 16 bound volumes, and 138 pamphlets and magazines, a total of 154, or a grand total available for consultation and study of 3,496. The entire library is open to the public.

The following is a detailed classification of the library:

# LIST OF PUBLICATIONS IN THE LIBRARY OF THE BOARD OF AGRICULTURE AND FORESTRY.

RELATING TO AGRICULTURE, FORESTRY AND GENERAL SUBJECTS.

| | Number. | |
|---|---|---|
| | Bound Volumes. | Pamphlets. |
| Publications of U. S. Department of Agriculture | 62 | 620 |
| Publications of other U. S. Departments: | | |
| U. S. National Museum | 14 | ..... |
| Smithsonian Institution | 18 | ..... |
| Census Bureau | 14 | 16 |
| Publication of State Experiment Stations (including Hawaii) | 48 | 1,200 |
| Publications of Government of Philippine Islands | .. | 65 |
| Publications of Government of Porto Rico | 1 | 1 |
| Publications of Agricultural Departments of Foreign Countries: | | |
| Australia | .. | 65 |
| Brazil | .. | 40 |
| Canada | .. | 50 |
| Ceylon | .. | 20 |
| England | .. | 16 |
| Germany | .. | 25 |
| India (Calcutta) | .. | 151 |
| Japan | .. | 21 |
| Java | .. | 55 |
| Madras | .. | 12 |
| Netherlands | .. | 22 |
| New Zealand | 4 | 100 |
| Tasmania | .. | 11 |
| West Indies | .. | 71 |

| | Number Bound Volumes. | Pamphlets. |
|---|---|---|
| Books on Botany | 17 | 4 |
| " " Forestry | 13 | 1 |
| " " Irrigation | 4 | ..... |
| " " General Agriculture | 8 | ..... |
| " " General Science | 9 | ..... |
| " " Law | 11 | 14 |
| Current periodicals received regularly | .. | 13 |
| Completed volumes of periodicals .... | .. | 10 |
| (Including complete set of Hawaiian Planters' Monthly) | 22 | ..... |
| | 245 | 2,603 |
| Total | | 2,848 |

RELATING TO ENTOMOLOGY.

| | Number. Bound Volumes. | Pamphlets. |
|---|---|---|
| Publications of State Experiment Stations | .. | 210 |
| Publications of Department of Agriculture | 4 | 120 |
| Publications of States, Scientific Societies and Other Institutions: | | |
| Entomologist's Annual Reports— | | |
| New York State | 3 | 6 |
| New York State Museum | .. | 13 |
| New Jersey | .. | 4 |
| Connecticut | .. | 2 |
| New Zealand Department of Agriculture | .. | 4 |
| Natal, Department of Agriculture.. | .. | 2 |
| Cape of Good Hope | .. | 2 |
| Entomological Society of Ontario ... | .. | 1 |
| Report upon Cotton Insects | 1 | ..... |
| Handbook of Destructive Insects of Victoria | 3 | ..... |

| | Number Bound Volumes. | Pamphlets. |
|---|---|---|
| Canadian Entomologist (7 vols. unbound) | 18 | ..... |
| Reports, Minister of the Interior | .. | 6 |
| Report, Commissioner of Agriculture | .. | 1 |
| Fauna Hawaiiensis | .. | 12 |
| Flora of Hawaiian Islands | 1 | ..... |
| Hawaii Agricultural Experiment Station | .. | 4 |
| Smithsonian Institution | .. | 27 |
| U. S. National Museum | .. | 7 |
| Proceedings Boston Society, Natural History | 1 | ..... |
| Imperial Department of Agriculture for West Indies | .. | 2 |
| Economic Entomology | 1 | ..... |
| Zoological Record | 39 | ..... |
| | 71 | 423 |
| Total | | 494 |

LIBRARY OF HAWAIIAN LIVE STOCK BREEDERS' ASSOCIATION, LOANED TO BOARD OF AGRICULTURE AND FORESTRY.

| | Bound Volumes. | Pamphlets. |
|---|---|---|
| Books | 16 | 90 |
| Breeder's Gazette | .. | 23 |
| Miscellaneous magazines and papers | .. | 25 |
| | 16 | 138 |
| Total | | 154 |

SUMMARY.

| | |
|---|---|
| Board of Agriculture Library | 3,342 |
| Live Stock Breeder's Library | 154 |
| Total | 3,496 |

PUBLICATIONS.

The Board early felt that a medium for disseminating information concerning the subject matters which it was created to conserve, was required. In January, 1904, "The Hawaiian Forester and Agriculturist," a monthly magazine of ordinary size and of form, 25 to 50 pages, was accordingly established, under the editorship of Mr. W. M. Giffard. Mr. Giffard has rendered most valuable service in this connection free of charge

In this magazine have been published the rules adopted by the Board, many of the reports of the Superintendents of Entomology and Forestry, the official proclamations setting apart forest reserves, specially contributed articles on forestry, agriculture and entomology in Hawaii, editorials and reprinted articles from foreign publications. A valuable exchange list has been established.

The publication has proved all and more than was hoped for it. In addition to the monthly magazine, special bulletins and publications have been issued as follows:

1. Reprint of Act 44, Session Laws of 1903, of the Legislature of the Territory of Hawaii.

2. "Notice to Importers." A reprint of Sections 13 to 16, inclusive, of Act 44; a four-page circular.

3. A "Digest of Statutes relating to the Importations of Soils, Plants, Fruits, Vegetables, etc., into the Territory of Hawaii; a six-page circular.

4. A notice to Ship Owners, Fruit Importers and others; a three-page circular

Bulletin No. 1—Division of Entomology. "The Leaf-Hopper of the Sugar Cane," by R. C. L. Perkins; 38 pages.

Press Bulletin—Division of Entomology. "On Some Diseases of Cane specially considered in relation to the Leaf-Hopper Pest, and to the Stripping of Cane;" 4 pages. (This should be regarded as Press Bulletin No. 1, Division of Entomology.)

CO-OPERATION WITH OTHER ORGANIZATIONS.

The Board has maintained most cordial relations with the National Bureau of Forestry at Washington; the Federal Agricultural Experiment Station at Honolulu and the Hawaiian Sugar Planters' Association. The latter organization has been,

and still is most public spirited and generous in its assistance in support of the entomological division of this Board. It has for years paid half the salary of the Superintendent of Entomology. During the first year of the past period it paid one-half the salary of three of the four entomologists in the service of the Board. Even now, when it has established an elaborate entomological station of its own, it still pays half of the salary of two of the three entomologists in the employ of the Board.

The station maintained by the Planters' Association is fully equipped in the agricultural, chemical and entomological divisions, and is doing splendid work in connection with the development of the sugar cane industry. It is an institution of which any community might well be proud.

The Federal Agricultural Experiment Station is practically conducting the work of the agricultural division of this Board, its superior equipment enabling it to do this more advantageously than the Board could do it. Moreover duplicating work is prevented by this policy.

The value of the quiet but systematic work which is being carried on by this branch of the Federal Government is not fully appreciated in Hawaii. Much of the work of the staff does not produce immediate results; but as time goes on, the value to the Territory of a body of trained men who are devoting their entire time to studying ways and means of promoting diversified industries will become more and more apparent.

It must be remembered that although the chief cost of the station is borne by the Federal Government, the benefits derived therefrom inure wholly to the people of this Territory. The assistance heretofore rendered to the station by the Territorial legislature has shown valuable results, and the Board are of the opinion that the agricultural interests of Hawaii will be subserved by liberally assisting the Federal Station in the future.

A more detailed statement of the accomplishments of the station is contained hereinafter, under the head of "Agriculture."

### RULES AND REGULATIONS.

The Board has passed rules and regulation, which have been approved by the Governor, as follows:

1. Prohibition of importation of cacao seeds or plants from Dutch East Indies, Ceylon and India; coffee seeds or plants from Samoa, and pineapples from Australia; September 1, 1903.

2. Prohibition of importation of banana fruits or plants from islands of the South Pacific ocean; February 10, 1904.

3. Prohibition of importation of sugar cane, except small quantities of special varieties for seed purposes; February 18, 1904.

4. Prohibition of importation of the flying fox, land crab, or any other animal, bird, reptile or insect injurious, or liable to become injurious to forests, trees, plants or other vegetation of value; October 19, 1904.

5. Prohibition of importation of fresh fruit from East or West Indies, Asia, Australia, Oceanica, Malaysia, Mexico, Central or South America, for the purpose of preventing the introduction of fruit flies and other injurious insects.

# FORESTRY.

## APPOINTMENT OF SUPERINTENDENT OF FORESTRY.

On November 25, 1903, the Board appointed Mr. Ralph S. Hosmer as Superintendent of Forestry on the recommendations of Gifford Pinchot, Chief of the Federal Bureau of Forestry, and of Wm. L. Hall, Chief of the Division of Forestry Extension.

Mr. Hosmer arrived in Honolulu on January 13, 1904, and began work immediately.

Mr. Hosmer is a graduate of Harvard, and of the Yale Forest School, holding the degrees of Bachelor of Agricultural Science from Harvard and of Master of Forestry from Yale. He has also been an instructor in the Yale Forest School.

Since 1896 he has been connected with the U. S. Department of Agriculture, first for two and a half years in connection with the Bureau of Soils and since then with the Bureau of Forestry. He has worked in this connection at Washington, D. C., and in Maine, New York and California.

## DISTRICT FORESTERS.

District Foresters, serving without salary, have been appointed as follows:

Island of Kauai.—Albert S. Wilcox, Andrew Moore, Geo. H. Fairchild, F. Weber, J. M. Lydgate, Francis Gay.

Island of Oahu.—Paul R. Isenberg, Walter F. Dillingham, A. M. Nowell, Andrew Adams, L. L. McCandless, C. Bolte, John Herd.

Island of Molokai.—G. C. Munro.

Island of Maui.—L. Barkhausen, H. P. Baldwin, C. B. Wells, H. A. Baldwin, L. von Tempsky, Dr. J. H. Raymond.

Island of Hawaii.—E. E. Olding, F. W. Carter, D. Forbes, Geo. Ross, John Watt, Julian Monsarrat, G. C. Hewitt, Franz Buchholtz, W. R. Castle, J. D. Paris, John Maguire.

The reports of the Superintendent and of the District Foresters are appended hereto.

FOREST RESERVES.

The segregation of public and private forest reserves is one of the most vital of the objects of the forestry law.

The Board is disappointed at having to report so small an area of forest reserve as having been set apart.

The reasons are: First it was desired to secure a man in touch with the Federal Forestry Bureau. The chief of that bureau was therefore asked to recommend a man. Before doing so he wished to know more of the conditions, and therefore first sent out the Chief of the Division of Forestry Extension, Mr. William L. Hall. He made a three-months trip and a thorough examination and report. Mr. Ralph S. Hosmer was recommended and appointed, but did not get to work until January, 1904.

It was felt to be advisable that he should become acquainted with the Territory before deciding upon details of given sections. A large part of his time has therefore been consumed in inspecting the different islands and meeting the people. Organizing the office, correspondence and necessary preliminary routine detail has also taken a good deal of his time.

A good beginning has been made however. Two pieces of government land have been set apart as forest reserves:

1. The land of Kaipapau, Koolauloa, Oahu, containing an area of 913 acres.

2. The land in North Hamakua, Hawaii, lying between Waipio Valley and the Kohala district, containing approximately 17,000 acres.

Reserves in Hilo, Hawaii, Hamakua, Koolau and Makawao, Maui, and Hanalei, Kauai, are being surveyed and preliminary work has been done on reserves in a number of other districts.

Large areas have been reserved by private persons and companies, and negotiations are now under way on a large scale to secure the incorporation of these reserves with those of the government, in order to secure a homogeneous and progressive administration of the whole system.

*Care of Forest Reserves.*

A number of public and private forest reserves have been set apart; but as yet, owing to lack of funds, no forest rangers have

been appointed, and the only care which the reserves are getting is that given them by friendly disposed private parties living in the vicinity. This has sufficed thus far without any particular resulting harm; but as the reserves increase protecting rangers will become a necessity, both to protect the existing forest and to supervise re-foresting operations.

### *Self-Support of Forests.*

Many of the Hawaiian forests are in such inaccessible locations that no return other than the effect on climate and the water which they conserve, can be expected from them; but in other localities there is no reason why, in the early future, a considerable revenue should not be obtained from forest products.

### *Fencing of Forests.*

No appropriation was made for fencing forests on any scale, and none has been attempted by the Board.

Fencing stock out of the forest has been done on a large scale however by private parties. Well over 200 miles of wire fence has been constructed for this purpose.

It is believed that private persons and companies interested in maintaining forest reserves will do nearly all the fencing that will be required in the immediate future.

## RE-FORESTING.

The main attempts by the government at re-foresting are at Tantalus and Nuuanu valley, Oahu.

The forest at Tantalus is doing well. No further planting has been done there for several years past. It is seeding freely and thus furnishing seed for planting elsewhere on the islands.

Planting at Nuuanu was discontinued during 1904, the results not being deemed to be commensurate with the expense. The chief obstacle to forestry growth there is the excessive and continuous wind. After some of the surviving trees heretofore planted are large enough to act as a breakwind, it will probably be sound to again plant there.

Tree planting on a small scale has been done and is still going on at a large number of places on the islands.

The principal tree planters on a large scale are G. N. Wilcox and the Lihue Plantation, on Kauai; the Haiku and Paia Plantations and the Haleakala Ranch Co., on Maui, and the Kohala Plantation, the Parker Ranch and the Pacific Sugar Mill, on Hawaii. It is hoped and believed that this list will be largely added to at an early date.

The Board already offers the free service of a tree planting expert to advise as to the best varieties of trees to plant and how to plant them. This offer has been accepted in some thirty instances. The Board hopes that more will avail themselves of the opportunity during the coming period.

### *Distribution of Trees and Plants.*

During 1904 the Board discontinued the general free distrimution of trees and plants at the government nursery. Those on hand were sold at about cost price and the receipts paid into the Treasury as a realization. Since then only trees and plants enough for public and semi-public purposes are being grown, with a few still left on hand.

In place of the former policy, seeds of trees and valuable plants are being imported and collected from local sources, and sold at just enough to cover cost.

The reason for this course is that the expense of propagation seemed altogether out of proportion to the number benefited and the good done.

It is believed that the change of policy will accomplish much more in the way of practical increase of forest, and a considerable decrease in expense.

### COLLECTION OF WOODS.

A collection of specimens of island woods has been secured and cut in such a way as to show both a segment and longitudinal section of the logs. One-half of each cut surface is polished and half left unpolished, showing the natural appearance of the wood.

The following is a list of the 44 species of woods collected, viz:

LIST OF THE HAWAIIAN WOODS IN THE MUSEUM OF THE BOARD OF AGRICULTURE AND FORESTRY.

| Scientific Name. | Common Name. | Hawaiian Name. |
|---|---|---|
| *Acacia koa* | ..... | Koa |
| *Acacia koa* | Black Koa | Koa |
| *Acacia koa* | Curly Koa | Koa |
| *Acacia koaia* | ..... | Koaia |
| *Albizzia saman* | Monkey Pod | ..... |
| *Alphitonia ponderosa* | ..... | Kauila |
| *Antidesma platyphyllum* | ..... | Haa |
| *Calophyllum inophyllum* | ..... | Kamanu |
| *Caesalpinio kauaiensis* | ..... | Uhiuhi |
| *Cheirodendron gaudichaudii* | ..... | Olapa |
| *Cocos nucifera* | ..... | Niu |
| *Cordia subcordata* | Cocoanut Palm | Kou |
| *Cyanea solenocalyx* | ..... | Puakala |
| *Dodonaea viscosa* | ..... | Aalii |
| *Erythrina monosperma* | ..... | Wiliwili |
| *Eugenia malaccensis* | ..... | Ohia Ai |
| *Eugenia sandwicensis* | ..... | Ohia Ha |
| *Gouldia coriacea* | ..... | Manono |
| *Hibiscus kokia* | ..... | Kokio |
| *Hibiscus tiliaceus* | ..... | Hau |
| *Mangifera indica* | Mango | Manako |
| *Metrosideros polymorpha* | ..... | Ohia Lehua |
| *Morinda citrifolia* | ..... | None |
| *Myrsine kauaiensis* | ..... | Koolea |
| *Myoporum sandwicensis* | ..... | Naio |
| *Olea sandwicensis* | ..... | Pua |
| *Pelea* sp. | ..... | Alani |
| *Pipturus albidus* | ..... | Mamake |
| *Psidium guajava* | Guava | Kuawa |
| *Prosopis juliflora* | Algaroba | Kiawe |
| *Reynoldsia sandwicensis* | ..... | Ohe |
| *Santalum freycinetianum* | Sandalwood | Iliahi |
| *Sapindus oahuensis* | ..... | Kopa |
| *Straussia hawaiiensis* | ..... | Kopiko |
| *Tamarindus indica* | Tamarind tree | ..... |

| Scientific Name. | Common Name. | Hawaiian Name. |
|---|---|---|
| *Terminalia catappa*..... | Tropical almond | Kamani |
| *Thespesia populneus*..... | ..... | Milo |
| *Wikstroemia foetida* ..... | ..... | Akia |
| ..... | ..... | Aawa |
| ..... | ..... | Alaa |
| ..... | ..... | Mahoe |
| ..... | ..... | Manele |
| ..... | ..... | Paihi |
| ..... | ..... | Uhiapele |

# ENTOMOLOGY.

### APPOINTMENT OF ENTOMOLOGISTS.

Immediately after its organization the Board on May 18, 1903, appointed Prof. A. Koebele, Superintendent of Entomology, and R. C. L. Perkins as Assistant Superintendent. Later it appointed Mr. G. W. Kirkaldy an assistant, he beginning work on August 14th, 1903, and Mr. F. W. Terry, who began work on September 2nd, 1903.

The Hawaiian Sugar Planters' Association paid one-half of the salary of Messrs. Koebele, Kirkaldy and Terry.

### PLANTERS' ENTOMOLOGICAL STATION.

By reason of the great destruction wrought by the leaf-hopper, the Planters decided in the summer of 1904 to establish an entomological division of their own, in connection with the experiment station, thus enabling an adequate force to devote itself exclusively to the study, and to provide remedies for cane pests and diseases.

By mutual agreement with the Board, Messrs. Perkins, Kirkaldy and Terry were transferred in August, 1904, to the Planters' Association, the latter assuming the entire payment of their salaries. These gentlemen are experts in their profession, and made a most valuable beginning in the establishment of the entomological division. We cannot regret their transfer to the Planters' station however, as with true scientific spirit, the entomologists of the two stations are in accord, assisting and supplementing the work, each of the other.

Prof. Koebele also resigned his position as superintendent, owing to the fact that his entire time was occupied in traveling abroad and obtaining parasites of injurious plants and insects.

To provide for the vacancies thus caused the Board thereupon appointed Mr. Alexander Craw of San Francisco, Superintendent of Entomology, he entering upon his duties on August 12, 1904. The Planters' Association has agreed to pay one-half of his salary.

Prof. A. Koebele was appointed Consulting Entomologist, and continued in his previous duties abroad.

Later Mr. Jacob Kotinsky of Washington, D. C., was appointed assistant, and took office September 14, 1904.

The Entomological Division of the Board is at present composed of Alexander Craw, Superintendent and Inspector; A. Koebele, Consulting Entomologist; Jacob Kotinsky, Assistant Entomologist; and C. J. Austin, Inspector's Assistant.

Professor Koebele requires no introduction to the people of Hawaii. His long and successful labors have established his reputation as one of, if not, the most eminent of economic entomologists.

*Mr. Alexander Craw.*

Mr. Alexander Craw is a Scotchman by birth. He was educated at home in the nursery business; was successively, second in charge of the propagating department of the Royal nurseries at Ascot, England; manager of the nurseries of Martin and Sons of Cottingham, England; manager of a nursery at San Diego, Cal.; and manager of the Wolfskill orange and lemon groves at Los Angeles, for twelve years. In 1890 he was appointed by the State Board of Horticulture of California as state horticultural quarantine officer, with headquarters at San Francisco.

Mr. Craw has for many years made a study of predacious insects and their parasites. He is one of the foremost advocates and exponents of the policy of fighting insects, blights and scales with their natural enemies. It was upon his advice and through his efforts that Prof. A. Koebele was first sent out to seek the enemy of the cottony cushion scale, which was devastating the citrus groves of California, resulting in the discovery and introduction of the *Vedalia cardinalis,* which speedily and completely eradicated the pest in California.

So carefully has Mr. Craw guarded the port of San Francisco, that since his encumbency of the office no new harmful insects have become established in California.

What his presence in Honolulu means to Hawaii can be judged from the fact that Professor Perkins states that practically all of the insects now doing serious injury to agriculture in Hawaii have been introduced here during the last ten years.

Mr. Craw personally meets and inspects every vessel arriving at Honolulu. He has already discovered and destroyed many dangerous insect pests not now in the Territory, thereby preventing their introduction. The Board considers that this branch of its work is of the utmost importance.

### *Mr. Jacob Kotinsky.*

Mr. Jacob Kotinsky, the assistant entomologist, is a graduate of the Agricultural Department of Rutgers College, economic entomology being one of the principal subjects of his study. He later established an agricultural school for boys, teaching natural history and pursuing his entomological studies in the field. In 1899 he was appointed to the Federal Bureau of Entomology at Washington, making a specialty of scale study. He was placed in charge of the breeding and dissemination of an introduced lady bird that feeds upon the "San Jose Scale," a most destructive scale, meeting with such success as to earn promotion in the bureau. Upon the Board seeking an assistant entomologist, Mr. Kotinsky was highly recommended, both by Prof. Koebele and Dr. Howard, chief of the Federal Bureau of Entomology.

Mr. Kotinsky's duties are the care of the office, breeding and distribution of beneficial insects, inspection of existing insect pests, collection and classification of specimens, etc.

### *Honorary Inspectors at Ports of Entry.*

By the kindness of Mr. E. R. Stackable, Collector of Customs at Honolulu, and of the several gentlemen hereunder named, the several Federal Collectors of Customs at the various ports of entry of the Territory have accepted commissions as Honorary Entomological Inspectors, serving as such officers without salary.

The names and jurisdictions of said officers is as follows:

E. A. Frasier, Mahukona, Hawaii.
J. Castle Ridgeway, Hilo, Hawaii.
W. O. Aiken, Kahului, Maui.
W. D. McBryde, Koloa, Kauai.

### ENTOMOLOGICAL WORK.

The work of the Division of Entomology involves an immense variety and amount of detail. The two main points around

which and to which all other things have been subordinate are:

First. Inspection and quarantine disinfection or destruction, wherever necessary, of fruits and plants entering the Territory, with a view to prevent the introduction of new insect pests.

Second. Seeking and disseminating parasites of the leaf-hopper.

The loss to the Territory was so great and the field over which damage was being done was so wide that the Board felt that the specializing of efforts to eliminate the leaf-hopper was warranted. Now that the Planters have established an entomological division of their station, this branch of the work of the Board has been relinquished to them.

Third. Considerable has also been done in the way of introducing insect enemies of other predacious insects which are doing injury to other agricultural and stock interests.

The reports of the entomological staff show in detail what has been done in this respect.

Mr. D. L. Van Dine, the Entomologist of the Federal Station, has also done valuable work of an entomological character, in connection with general agriculture.

## AGRICULTURE.

In accordance with the proviso in Act 44, the Board has avoided duplicating the work being done by the Federal Experiment Station, and most of the agricultural work coming within the jurisdiction of the Board has been carried on in conjunction with, and through the Federal station.

The two lines of work which at present promise the most immediate beneficial results are in connection with the introduction of the "Bluefields bananas" and the production of a marketable tobacco.

### BLUEFIELDS BANANAS.

The Bluefields banana, so-called by reason of Bluefields being the principal port from which this particular kind of banana was first shipped to the United States, has superceded almost every other kind of banana consumed in the United States, except the China variety produced in Hawaii and consumed on the Pacific Coast. It is not quite so delicately flavored as the China or the Jamaica red banana, but it possesses several other qualities which make it by far the best shipping banana that there is, viz:

1. The China banana has a delicate skin, easily bruised, and turns black when bruised. It therefore has to be wrapped in a thick sheathing of leaves and grass, adding greatly to the expense of handling, and nearly doubling the space occupied.

2. The Bluefields banana has a tough skin, not easily bruised and which does not easily discolor. Consequently it does not have to be wrapped.

3. The China banana ripens quickly, becomes spotted, and softens at the stem and drops off the bunch, within a few days after it is ripe.

4. The Bluefields ripens slowly, maintains a clear, golden yellow color, and merely dries at the stem, so that it will last a week or more longer than the China, under like conditions.

5. The China banana projects at right angles from the bunch.

6. The Bluefields slopes upward and backward, along the stem, packing closer and being less liable to injury than the China.

By reason of these several and manifest advantages, numerous private individuals have for many years past attempted to secure Bluefields banana plants for planting in Hawaii; but so jealously do the countries in which this banana grows, guard the export of the plants that the attempt has never been successful.

Through the good offices of Mr. Jared G. Smith, the Federal Agricultural Department at Washington agreed to, at its own expense, despatch a special agent to secure the plants, if the Board would pay the freight. This generous offer was accepted, and in January, 1904, 325 banana stumps were received. Of these 110 survived and grew. These have been propagated at the station, producing 275 shoots; 130 of these have been sent to Hilo, and are being used at the experiment station there, to propagate suckers, while the remainder are being similarly treated in Honolulu.

As soon as enough have been produced to warrant it, the young shoots will be distributed among practical banana growers.

If this experiment results in the successful establishment of the Bluefields banana as an article of export from Hawaii, it will repay the entire expense of this bureau many fold, for, with its superior shipping qualities, it will greatly extend the field which can be supplied from Hawaii, now practically limited to San Francisco and its immediate vicinity.

## TOBACCO PRODUCTION.

Many attempts to produce merchantable tobacco, have been made in Hawaii, all resulting, so far, in commercial failure. The reasons for this result are numerous. Among others are undoubtedly the following:

1. The attempts were made by inexperienced men.
2. The experimenters had but little capital, and depended upon immediate success to enable them to go on.
3. The qualities which render a given lot of soil suitable for tobacco, and another in the same vicinity unsuitable, are but little understood, and it is only by practical experiment, more or less costly, that this can be demonstrated.

At the suggestion of Mr. Jared G. Smith, the Board and the Federal Station have jointly borne the expense of a tobacco producing station at Hamakua, Hawaii. Many obstacles and difficulties have been met. The experiment is still being carried on. The results so far achieved, however, are most encouraging. A considerable amount of tobacco, upward of 1,000 pounds, has been harvested and is now being cured. A Havana tobacco of good quality has been produced. Some cigars, made entirely of Hawaiian tobacco, have been rolled, and will be presented to you, as a demonstration of the possibilities of tobacco in Hawaii. It is most earnestly hoped that this experiment may be continued to final demonstration.

Other experiments and plans for the future, are set forth in the report of Mr. Jared G. Smith, Superintendent of the Federal Agricultural Experiment Station, accompanying this report. A full report of the results and details of the tobacco experiment will soon be published, as a special bulletin.

## THE FUTURE.

The Board submits herewith a statement of its expenditures up to the 31st of December, 1904, and an estimate of amounts which it deems sound to expend during the coming period. It believes that a much larger amount could be advantageously expended, but in view of the financial condition of the Treasury it has kept its estimates down to the lowest limits, which, in its opinion, will suffice to carry on the necessary work under its jurisdiction.

## APPROPRIATIONS FOR BOARD OF AGRICULTURE, HORTICULTURE AND FORESTRY PASSED BY LEGISLATURE OF 1903 FOR THE 6 MONTH'S PERIOD—JULY 1 TO DECEMBER 31, 1903.

### SALARIES AND PAY ROLLS.

| | Appropriations | Expended | Unexpended |
|---|---|---|---|
| Pay of Superintendent of Forestry | $ 1,500.00 | $ 137.10 | $ 1,362.90 |
| Assistants, Rangers (to inclue 1 Ranger for Molokai), Employees and Laborers of Division of Forestry | 6,000.00 | 2,568.69 | 3,431.31 |
| Pay of Superintendent of Entomology | 1,500.00 | 1,500.00 | ..... |
| Pay of Assistant Entomologists | 2,500.00 | 2,266.93 | 233.07 |
| Assistants, Inspectors and Employees of Division of Entomology | 1,500.00 | 628.75 | 871.25 |
| Pay of Clerk and Messenger | 300.00 | ..... | 300.00 |
| Pay of Stenographer and Typewriter | 600.00 | 600.00 | ..... |
| Federal Experiment Station—Chemist | 500.00 | 250.00 | 250.00 |
| Totals | $14,400.00 | $ 7,951.47 | $ 6,448.53 |

### CURRENT EXPENSES.

| | Appropriations | Expended | Unexpended |
|---|---|---|---|
| Incidentals and General Expenses of Board, including importation, collection and propagation of seeds and plants | $ 2,000.00 | $ 560.84 | $ 1,439.16 |
| Apparatus and Library | 250.00 | 119.37 | 130.63 |
| Traveling Expenses of Commissioners | 125.00 | 46.50 | 78.50 |
| Incidentals, General Expenses and Maintenance of Division of Forestry, including fencing, building and tree propagation | 5,000.00 | 3,428.84 | 1,571.16 |
| Traveling Expenses, Superintendent of Forestry | 250.00 | 186.30 | 63.70 |
| Incidentals, General Expenses and Maintenance of Division of Entomology, including buildings, disinfecting and quarantine expenses and material, importation, propagation and distribution of beneficial insects, and Traveling Expenses of Entomologists | 2,500.00 | 2,065.07 | 434.93 |
| Farmers' Institute | 75.00 | ..... | 75.00 |
| Agricultural and Horticultural Fairs | 1,250.00 | ..... | 1,250.00 |
| Assistance to Federal Experiment Station at Honolulu, to be expended under the direction of the Board | 2,500.00 | 1,914.59 | 585.41 |
| Totals | $13,950.00 | $ 8,321.51 | $ 5,628.49 |

APPROPRIATIONS FOR BOARD OF AGRICULTURE, HORTICULTURE AND FORESTRY PASSED BY LEGISLATURE OF 1903 FOR THE 18 MONTH'S PERIOD, (AMENDED AT THE SPECIAL SESSION OF 1904 TO 6 MONTHS,) JAN. 1 TO JUNE 30, 1904.

SALARIES AND PAY ROLLS.

| | Appropriations | Expended | Unexpended |
|---|---|---|---|
| Salary of Superintendent of Forestry.... | $ 4,500.00 | $ 1,500.00 | $ 3,000.00 |
| Assistants, Laborers and Rangers, Division of Forestry ..... | 15,000.00 | 2,172.92 | 12,843.75 |
| Salary of Superintendent of Entomology | 4,500.00 | 1,500.00 | 3,000.00 |
| Pay of Assistant Entomologists..... | 7,500.00 | 2,150.00 | 5,350.00 |
| Pay of Assistants, Inspectors and Employees, Division of Entomology..... | 4,500.00 | 989.00 | 3,511.00 |
| Pay of Clerk and Messenger..... | 900.00 | 300.00 | 600.00 |
| Federal Experiment Station—Chemist.. | 1,500.00 | 500.00 | 1,000.00 |
| Totals . . . ..... | $38,400.00 | $ 9,111.92 | $29,304.75 |

CURRENT EXPENSES.

| | Appropriations | Expended | Unexpended |
|---|---|---|---|
| Incidentals and General Expenses of Board, including importation, collection and distribution of seeds and plants . . ..... | $ 6,000.00 | $ 1,460.89 | $4,539.11 |
| Apparatus and Library ..... | 750.00 | 166.94 | 583.06 |
| Traveling Expenses of Commissioners.. | 375.00 | ..... | 375.00 |
| Incidentals, General Expenses and Maintenance of Division of Forestry, including buildings, fencing and tree propagation . . ..... | 15,000.00 | 569.75 | 14,430.25 |
| Traveling Expenses, Superintendent of Forestry . . ..... | 750.00 | 135.40 | 614.60 |
| Incidentals, General Expenses and Maintenance of Division of Entomology, including buildings, disinfecting and quarantine expenses and material, importation, propagation and distribution of beneficial insects, and traveling expenses of Entomologists..... | 7,500.00 | 785.26 | 6,714.74 |
| Agricultural and Horticultural Fairs.... | 3,500.00 | ..... | 3,500.00 |
| Farmers' Institute ..... | 225.00 | 60.80 | 164.20 |
| Assistance to Federal Experiment Station at Honolulu ..... | 7,500.00 | 1,016.70 | 6,483.30 |
| Totals . . ..... | $41,600.00 | $ 4,195.74 | $37,404.26 |

## APPROPRIATIONS FOR BOARD OF AGRICULTURE, HORTICULTURE AND FORESTRY PASSED BY THE LEGISLATURE OF 1904, AT THE SPECIAL SESSION, FOR THE FIRST 6 MONTHS OF THE 12 MONTH'S PERIOD, JULY 1, 1904, TO JUNE 30, 1905. JULY 1 TO DEC. 31, 1904.

### SALARIES AND PAY ROLLS.

| | Appropriations | Expended | Balance on hand |
|---|---|---|---|
| Salary of Superintendent of Forestry ($250.00) | $ 3,000.00 | $ 1,500.00 | $ 1,500.00 |
| Pay of Assistants, Laborers and Rangers Division of Forestry | 2,700.00 | 1,342.00 | 1,358.00 |
| Salary of Superintendent of Entomology ($250.00) | 3,000.00 | 1,451.61 | 1,548.39 |
| Pay of Assistants, Inspectors and Employees, Division of Entomology | 7,280.00 | 3,415.20 | 3,864.80 |
| Salary of Clerk and Stenographer | 900.00 | 450.00 | 450.00 |
| Totals | $16,880.00 | $ 8,158.81 | $ 8,721.19 |

### CURRENT EXPENSES.

| | Appropriation | Expended | Balance on hand |
|---|---|---|---|
| Incidentals and General Expenses | $11,780.00 | ($2,294.93) Liabilities (2,612.73) | |
| | | $ 4,907.66 | $ 6,872.34 |

| | Appropriation | Expended | Balance on hand |
|---|---|---|---|
| Assistance to Federal Experiment Station | $ 2,736.00 | $ 1,509.32 | $ 1,226.68 |

ESTIMATE OF APPROPRIATIONS FOR THE BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY FOR THE BIENNIAL PERIOD, JULY 1, 1905, TO JUNE 30, 1907.

(As amended and submitted by Finance Committee to Board of Commissioners of Agriculture and Forestry, Jan. 31st, 1905.)

# DIVISION OF ENTOMOLOGY.

## SALARIES AND PAY ROLLS.

| | Per annum | Per period |
|---|---|---|
| Superintendent of Entomology and Inspector | $ 3,000.00 | $ 6,000.00 |
| Consulting Entomologist | 3,000.00 | 6,000.00 |
| First Assistant Entomologist | 2,100.00 | 4,200.00 |
| Second Assistant Entomologist | 1,200.00 | 2,400.00 |
| Inspector's Assistant (Division of Entomology) | 1,500.00 | 3,000.00 |
| Clerk and Stenographer (Division of Entomology) | 900.00 | 1,800.00 |
| One-half (Forestry the other half) janitor, driver | 300.00 | 600.00 |
| One-half ( " " " " ) yard worker | 180.00 | 360.00 |
| One-half ( " " " " ) general clerk | 300.00 | 600.00 |
| Totals | $12,480.00 | $24,960.00 |

## CURRENT EXPENSES.

| | Per annum | Per period |
|---|---|---|
| Apparatus and laboratory supplies | $ 500.00 | $ 1,000.00 |
| Books and periodicals | 500.00 | 1,000.00 |
| Freights | 150.00 | 300.00 |
| Totals | $ 1,150.00 | $ 2,300.00 |

## RECAPITULATION.

| | Per annum | Per period |
|---|---|---|
| Division of Entomology— | | |
| Salaries and Pay Rolls | $12,480.00 | $24,960.00 |
| Current Expenses | 1,150.00 | 2,300.00 |
| Totals | $13,630.00 | $27,260.00 |

# DIVISION OF FORESTRY.

## SALARIES AND PAY ROLLS.

| | | Per annum | Per period |
|---|---|---|---|
| Salary of Superintendent of Forestry ($250) | | $ 3,000.00 | $ 6,000.00 |
| Assistants, Rangers, Employees and Laborers | | 13,720.00 | 27,440.00 |
| Pay of Field Foreman ($150.00) | $ 1,800.00 | | |
| " " two Laborers at Nursery ($30 each) | 720.00 | | |
| " " two Laborers at Nuuanu ($30 each) | 720.00 | | |
| " " six Forest Rangers ($100 each) | 7,200.00 | | |
| " " Laborers to be temporarily employed in planting Nuuanu and Tantalus forests and in other reserves, etc. | 2,500.00 | | |
| " " Wagon Driver and Janitor man and wife, one-half of $50.00 per month (other half to be paid by Division of Entomology) | 300.00 | | |
| " " Yardman on Nursery grounds one-half of $30.00 per month (other half to be paid by Division of Entomology) | 180.00 | | |
| " " Clerk and Messenger at $50.00 per month (other half to be paid by Division of Entomology) | 300.00 | | |
| | $13,720.00 | | |
| Pay of Stenographer, Division of Forestry ($100.00) | | 1,200.00 | 2,400.00 |
| Totals | | $17,920.00 | $35,840.00 |

## CURRENT EXPENSES.

| | Per an. | Per annum | Per period |
|---|---|---|---|
| Incidentals and General Expenses of Division of Forestry, including maintenance of Nursery and the marking of forest reserve boundaries with permanent monuments | | $ 3,350.00 | $ 6,700.00 |
| Maintenance of Nursery— | | | |
| Tools, boxes, pots, freights, etc. | $ 250 | | |
| Horse shoeing, feed, repairs to harness, wagon, etc. | 350 | | |
| Forestry books and publications | 750 | | |
| Forest reserve boundary monuments, including labor in setting same | 2,000 | | |
| | $3,350 | | |
| Fencing of forest reserve boundaries where unavoidable | | 2,000.00 | 4,000.00 |
| Totals | | $ 5,350.00 | $10,700.00 |

RECAPITULATION.

| | Per annum | Per period |
|---|---|---|
| Division of Forestry— | | |
| Salaries and Pay Rolls | $17,920.00 | $35,840.00 |
| Current Expenses | 5,350.00 | 10,700.00 |
| Totals | $23,270.00 | $46,540.00 |

# BOARD OF AGRICULTURE AND FORESTRY.

## CURRENT EXPENSES OF THE BOARD.

| | | Per annum | Per period |
|---|---|---|---|
| Incidentals and General Expenses of Board. Including— | | $ 6,700.00 | $13,400.00 |
| (1) The printing of By Authority and other notices and regulations, reports, "Hawaiian Forester and Agriculturist," bulletins and circulars of the Divisions of Forestry and Entomology, etc. | $ 1,750 | | |
| (2) Importation, collection, propagation and setting out of seeds and plants. | 1,500 | | |
| (3) Division and Board incidentals, postage, general office supplies and traveling expenses of Commissioners and of Division Superintendents and Assistants, viz: | 3,450 | | |
| Per an. | | | |
| Incidentals, etc., Board | 1,200 | | |
| Travelling expenses Board | 150 | | |
| Incidentals, stationery, etc., Forestry | 500 | | |
| Incidentals, stationery, etc., Entomology | 500 | | |
| Traveling expenses, Forestry | 600 | | |
| Traveling expenses, Entomology | 500 | | |
| | $3,450 | | |
| Library (books on Agriculture and special industries) | | 400.00 | 800.00 |
| Totals | | $ 7,100.00 | $14,200.00 |

## FEDERAL EXPERIMENT STATION.

| | Per annum | Per period |
|---|---|---|
| Assistance to Federal Experiment Station, expenditures to be subject to supervision of the Board of Commissioners of Agriculture and Forestry, for introduction of new agricultural industries and agricultural experiments, other than with sugar cane | $10,000.00 | $20,000.00 |

## GENERAL RECAPITULATION.

| | Per annum | Per period |
|---|---|---|
| Division of Entomology— | | |
| Salaries and Pay Rolls | $12,480.00 | $24,960.00 |
| Current Expenses | 1,150.00 | 2,300.00 |
| Division of Forestry— | | |
| Salaries and Pay Rolls | 17,920.00 | 35,840.00 |
| Current Expenses | 5,350.00 | 10,700.00 |
| Board— | | |
| Current Expenses | 7,100.00 | 14,200.00 |
| Assistance to Federal Experiment Station | 10,000.00 | 20,000.00 |
| Totals | $54,000.00 | $108.000.00 |

LORRIN A. THURSTON,
W. M. GIFFARD,
JAMES D. DOLE,
C. S. HOLLOWAY,
A. W. CARTER,
J. F. BROWN,

# FORESTRY.

## REPORT OF THE DIVISION OF FORESTRY.

BY

RALPH S. HOSMER,

SUPERINTENDENT OF FORESTRY.

HONOLULU, T. H., December 31, 1904.

THE BOARD OF COMMISSIONERS OF
AGRICULTURE AND FORESTRY,
Honolulu, T. H.

GENTLEMEN:—I have the honor to submit herewith the report of the Division of Forestry for the period from July 1, 1903, to December 31, 1904, with certain other matters bearing on forestry in the Territory.

The most notable features of the forestry work done by the Board from the passage of Act 44, which was approved April 25, 1903, up to the close of the year 1903, were the organization of the Board itself, the appointment of the local, unpaid, district foresters, for the several districts throughout the Territory,* the visit of Mr. William L. Hall, Chief of the Division of Forest Extension, U. S. Bureau of Forestry, and the appointment of the Superintendent of Forestry.

### FORESTER HALL'S VISIT.

Soon after the members of the Board were commissioned by Governor Dole, correspondence began with Mr. Gifford Pinchot, Forester of the United States Department of Agriculture, in reference to the appointment of a Superintendent of Forestry. To obtain accurate information upon which to act, Mr. Pinchot sent Mr. Hall to investigate and report upon the forest conditions and needs of the Territory. Mr. Hall's visit covered a period

*The names of the gentlemen who serve in this capacity are given at the end of this report.

of three months. During that time he visited all the leading islands in the group and got in close touch with the forest problems throughout the Territory. As a result of his visit there was published, early in 1904, by the U. S. Bureau of Forestry, a bulletin by Mr. Hall, entitled "The Forests of the Hawaiian Islands."

### APPOINTMENT OF SUPERINTENDENT OF FORESTRY.

Based upon the suggestions of Mr. Hall, Mr. Pinchot, in November, 1903, recommended my appointment as Superintendent of Forestry, I being at that time a member of the U. S. Bureau of Forestry. Acting on this recommendation, I was appointed by the Board, as Superintendent of Forestry, at the meeting held on November 25th, 1903; the appointment taking effect December 15, 1903. I arrived in Honolulu on January 13, 1904, and began active work at once.

### WORK OF THE SUPERINTENDENT OF FORESTRY DURING THE YEAR.

Coming to a new field the first step was, naturally, to get acquainted with local conditions. In this regard I have been exceptionally fortunate, having been invited by Governor Carter to accompany his party on the tours made by him to Hawaii, Kauai and Maui. On these trips an excellent opportunity was offered not only to secure a comprehensive general idea of the distribution and extent of the existing forest, but also to meet, under the most favorable auspices, the leading men throughout the Territory, on whose cooperation in the future the success of much of the forestry work depends.

The trip to Hawaii followed almost immediately upon my arrival in Honolulu and lasted for five weeks. That to Kauai came in May, covering eight days; while the one to Maui, in September, occupied a little more than a fortnight. The especial value of such general trips as these, preliminary to detailed investigations of given areas, was that they provided the means of obtaining a comprehensive knowledge of the forest conditions throughout the Territory; of the relative importance of the forest in different situations and localities; and of the various aspects of the many questions which must be considered in making a systematic and logical plan to cover the whole Territory.

Following my initial visit to Hawaii came a period of work in the office. Fortunately the new building of the Board, in the Government Nursery grounds, was completed in February so that no time was lost in getting the Division of Forestry established in its permanent home. Office furniture and equipment were purchased, collections of books and maps systematized or started, and the routine work of the office got under way in a business like manner. At this time, too, changes were made in the management of the Nursery and the Nuuanu Forest Station, which are discussed later in this report.

Short trips to a number of points on Oahu in March and April, notably in the Koolauloa and Ewa Districts, were followed in May and June by detailed examinations of the districts of North Kona and South Kohala on Hawaii; Halelea, Koolau and Puna on Kauai, and a visit to the Island of Lanai.

The greater part of July was taken up with a visit to the Hilo District, Hawaii, at which time a careful examination of the question of the proposed Hilo forest reserve was undertaken, and the location of the lower boundary determined. During August the central and south parts of Kona, Hawaii, were visited and at the end of the month the upper line of the proposed Hilo Reserve was settled upon.

In September came the trip to Maui, with Governor Carter, already mentioned. Most of October was spent in the office in the preparation of reports and the working up of notes. In November another trip was made to Maui, this time to investigate in detail the great forest reserve proposed for the Hamakuapoko, Hamakualoa and Koolau Districts.

December has been a month of reports and office work, save for one week when a short trip to Kau, Hawaii, was made to inspect some land belonging to the Bishop Estate, where it is proposed to lumber the mature Koa. This last visit was made in accordance with the offer of the Division of Forestry to give advice and assistance to owners of forest land, or others, desiring to handle their forests according to forestry methods.

### REDUCTION OF APPROPRIATION.

In the retrenchment of government appropriations which became necessary in the spring of 1904, to put the Territory on

a business basis, the appropriation for the Board of Agriculture and Forestry was heavily cut.

In the original appropriation for the eighteen months period, ending June 30, 1905, the Division of Forestry's portion was $35,625. On a pro rata basis, the amount for the twelve months ending June 30, 1905, would have been $23,750.

At the Special Session of the Legislature the amount appropriated for the Division of Forestry, for the twelve months period ending June 30, 1905, was $9,810. This is forty-one per cent. of the original amount.

The work of the Division of Forestry, was of course hampered in a number of ways by this reduction of funds, but owing to the fact that a large part of the cut fell on the money alloted for the pay of forest rangers, who had not been appointed, the reduction did not prove the serious set back to the forestry work which it might have been had the forest ranger system been well under way. It may therefore be regarded as fortunate that the cut was made when it was.

## ACKNOWLEDGMENTS.

Before passing to the consideration in detail of the forest problems which await solution, I wish to acknowledge my indebtedness to the various persons throughout the Territory who have extended to me the most cordial hospitality and given me assistance in many and varied ways.

To attempt to mention names would swell this report to the dimensions of a directory of the islands. I can therefore only say that my appreciation is sincere and my thanks most hearty.

## REPORT AND RECOMMENDATIONS BY DISTRICTS.

Based upon the field work described above I have to report as follows upon the several districts on the different islands in the group. Some districts must necessarily be passed over with brief mention because in less than a year it is physically impossible for one man to cover, except in a general way, so large an area as this Territory embraces. If therefore, some sections do not seem to be done full justice, it must be put down, not to a lack of desire on my part, but to the force of circumstances.

Frequent references will be made to the reports of the district foresters, These will be found as an appendix to this report in the latter part of this publication.

KAUAI.

Taken as a whole the forest problems on Kauai are simple ones. In the center of the island rises the mountain mass of Waialeale to an elevation of 5,240 feet. From its summit radiate a number of great spurs or ridges, all densely wooded to the top. In the valleys between flow streams which are of great importance, actual or potential, for the development of power and for irrigation.

In maintaining a constant and moderately even flow in these streams, the forest plays an important part, particularly as the value of the water for developing the agricultural land below is far greater than the returns would be from any other use to which the steep slopes from which it comes, could be put. A further reason why it is especially important that the forest on Kauai be preserved, is that with the necessarily small water-shed it is essential that all the water that can be impounded be made available for use.

The grazing interests on Kauai, save in one district, are not as important as elsewhere in the Territory, being largely subordinate to, and controlled by, the sugar plantations.

The question then, becomes one of reserving the forest above the point where the land can be profitably used for agriculture and for the necessary grazing.

*Halelea.*

The dominant characteristic of the forested portion of this district is its steep and rugged topography. High mountain ridges with precipitous slopes, alternate with deeply cut valleys, in which flow torrential streams, fed by the heavy and nearly constant rainfall on the slopes above. The rapid fall of the rivers makes the region one where great power could be developed, while there is also the possibility of making available some at least of the water for irrigation.

It is proposed that a forest reserve be established to include

the more rugged portions of this section, the lower boundary being drawn along the base of the steep slope. This lower boundary starts at the Na Pali District line and runs across the Wainiha, Lumahai, Waipa, Waioli, Hanalei, Kalihikai and Kalihiwai valleys, at about the edge of the existing forest, which is practically where the steep slope begins. The upper boundary of the reserve is the crest of the ridges. All good grazing and agricultural land is thus excluded.

Arrangements are now under way whereby certain of the privately owned lands lying within the limits of this forest reserve will be turned over to the Government for management, so that with the Government lands, the reserve will include a large area.

*Koolau.*

The existing forest in the Koolau District is practically confined to the steep slopes of the Koolau ridge. Below, on the gently sloping lands nearer the Government road, the original forest has almost disappeared, so that the forest problem presented is largely one of reforestation. If certain parts of this district were under a forest cover there is little doubt that the water there conserved would be of greater value than the returns now got from the use of the land for grazing. But as the Kilauea Plantation would be the one primarily benefitted by such reforestation, it is natural to look to that company to take the first and most active steps in whatever may be done.

In this connection attention is called to the report of the District Forester, Mr. Andrew Moore, which will be found elsewhere in this publication.

*Puna.*

In the Puna District, the forest on the mountain is important for the reasons already stated for the other districts; that it protects the water-sheds and helps to maintain a uniform flow of the streams. Its value on this account is well understood by both the Lihue Plantation and the Makee Sugar Companies, the two corporations controlling the greater part of the better land in this district.

The Makee Sugar Company has signified its willingness to cooperate with the Government in the establishment of a forest

reserve to include both government and private land. It is expected that this matter will be brought to a head in the spring of 1905, at which time the leases on certain government lands now held by that plantation, come within two years of the time when they expire.

The Lihue Plantation Company has had under fence since 1894 a considerable area of the forest land back of the plantation. Stock have been excluded and as a result a dense stand of Ohia Lehua (*Metrosideros polymorpha*) has sprung up. Beside the reservation of the native forest, the Lihue Plantation Company has also done much in the way of planting forest trees. Following the example of the Honorable G. N. Wilcox, who has for many years taken a deep interest in tree culture, the Lihue Plantation Company has planted since 1882 about 1,000 acres. The trees used have been principally Ironwood (*Casuarina equisetifolia*), Blue Gum (*Eucalyptus globulus*) and Koa, both the native and Australia species, (*Acacia koa* and *Acacia melanoxylon*). The idea of these forest plantations is to furnish a supply of fire-wood and to create a forest cover to retain the rainfall on areas where the soil is poor in quality. On fulfilling these requirements the plantations have been an eminent success. An annual supply of some 250 cords of fire-wood has been obtained, while from the planted area a stream of almost a million gallons of water a day has been developed.

Further details of this interesting work are given in the report of Mr. F. Weber, the District Forester, which appears later in these pages. A report from Mr. G. H. Fairchild is also published.

The forest reserve in this district should, when completed, include the land above a line drawn from the Anahola River along the lower edge of the existing forest, until it connects with the private reserve already set apart by the Lihue Plantation Company. Above this line the government land should be set apart and the private land turned over to the Government, under the terms of Act 44.

### *Kona.*

In view of the large irrigation works in this part of the island, the proposed Kona forest reserve is one of no small importance.

A start toward it has been made by the McBryde Sugar Company in fencing off some of their upper lands. Messrs. Gay and Robinson have also excluded cattle from the forest on certain of their lands. But to accomplish the desired result the fences should be extended until all the land properly to be classed as forest is included.

In this connection attention is called to the report of Rev. J. M. Lydgate, the District Forester.

In his report as District Forester for Waimea, Mr. Francis Gay makes note of the Algaroba forest (*Prosopis juliflora*) which has spread over the low lying lands in this section from the trees planted in the early eighties. His report should be read in this connection.

As I have only seen the Kona and Waimea Districts during the quick trip made with Governor Carter, when there was no opportunity to get into the forests, I have at this time only the above general recommendation to make. But the section is one which ought to be examined carefully and reported upon in detail. I hope to take it up during the coming year.

*Waimea and Na Pali.*

Greatly to my regret I have twice been obliged, by the press of work elsewhere in the Territory, to decline invitations from Mr. Augustus Knudsen to visit and inspect the Waimea District. Mr. Knudsen says that "in protecting part of our own ranch, Knudsen Brothers, have protected some fifteen or twenty square miles of Government land in the District of Na Pali, namely the upland of Kalalau," and suggests that a good deal more might be accomplished with comparatively little effort. Taken as a whole the Na Pali District has perhaps the most rugged topography of any part of the Territory. It is an almost uninhabited and a practically unexplored country.

It is evident that a considerable portion of the great stretch of swampy upland, in which the Waimea River heads, ought to be reserved, because of the importance of this stream below.

This section is also one which ought to be investigated. I trust to be able to take it up in the coming months.

The Island of Niihau has not yet been visited, so no recommendations can be given for it.

OAHU.

## *Ewa and Waialua.*

On Oahu there are two sections which should as soon as possible be set apart as forest reserves, viz: the western slope of the Koolau Mountains and the upper portion of the Waianae Hills. The former is the more important because on it depends, in no small measure, the water supply of the large and highly productive Ewa and Waialua Basins, with their great agricultural possibilities.

Owing to the barrier reef of coral and the clay stratum that with it makes an impervious wall on the south side of Oahu, the ground-water is held back on its way to the sea and furnishes a constant and unfailing supply to the various pumps and wells throughout the Ewa section. But if the forest now clothing the upper slopes were removed, much of the water which at present finds its way by the underground channels, slowly to the sea, would rush down in a few hours in floods and torrents, not only escaping its duty for irrigation and other uses but also endangering property along its course.

On the Waialua side the development of water through an elaborate irrigation system makes essential the conservation of all the streams which feed the flumes and ditches.

The exact location of the lower boundary of the proposed reserve has not yet been determined but it should follow approximately the lower edge of the existing forest on the Koolau Mountains, and on the Waianae Hills should include the greater part of the steep slopes.

A private forest reserve of some twenty thousand acres is now maintained on the Bishop Estate lands on the western slope of the Koolau ridge; fences having been built and cattle excluded for a number of years. This area forms a part of the land proposed to be reserved.

Mention should be made here of the experimental forest plantation of the Oahu Railway and Land Company at the southern end of the Waianae Ridge. It covers a number of acres and should yield valuable information in regard to the kinds of trees which will do best in this section. The object of the Railway Company is to find a hardy and quick growing tree, from which ties and other railroad timbers can later be cut.

In this connection the reports of Messrs. W. F. Dillingham and A. M. Nowell, the District Foresters for the Ewa and Waialua Districts, respectively, should be read. They will be found on a later page of this report.

*Waianae.*

The notable feature of this district from a forest standpoint is the dense stand of Algaroba extending all along the coast at the lower elevations. Because of its varied uses this forest is a valuable asset to the District.

No detailed examination has yet been made of the Waianae District, consequently no definite recommendations can here be made, except for the land of Waianae Uka. Portions of this tract ought unquestionably to be reserved, as forming part of the Waialua Basin, already discussed.

An examination of the native forest on the slopes above Waianae is one of the things which now await to be taken up.

*Koolauloa.*

The forest problem in this district is to protect the water sheds of the valleys at the northwestern end of the Koolau ridge, from which water may be developed and on which the supply of artesian wells of the district in the end depends.

One tract of government land on the eastern slope has already been set apart, as a forest reserve. This land, Kaipapau, enjoys the distinction of being the first forest reserve created under the present law. It was set apart by a proclamation signed by Governor Carter, on November 10th, 1904. The area is nine hundred and thirteen acres.

A preliminary examination has been made of the adjoining lands to the west and the District Forester, Mr. Andrew Adams, informs me that arrangements are under way, which will result in the reservation of a considerable additional area of private land now covered with native forest.

*Koolaupoko.*

On the windward side of the Koolau Ridge the forest is in good part protected by the character of the topography; the

slopes rising so abruptly and precipitously, that little harm can come to the forest on them. A preliminary examination has been made of the eastern end of the district but data on which to base recommendations for the district as a whole are not yet in hand.

At the Maunawili Ranch a considerable area has been planted with forest and other trees. For the details of the interesting work done here, the report of Mr. John Herd, the District Forester for the south end of the Koolaupoko District, should be read. Those of Messrs. C. Bolte and L. L. McCandless, the District Foresters for the middle and for the north end of the district should also be consulted as a part of the report on this section.

### *Kona.*

The steep slopes at the heads of the valleys near Honolulu, running up to the back bone of the Koolau ridge, ought eventually to be set apart and declared forest reserves but as they are protected because of their steepness and inaccessibility this section is not in immediate need of attention. In this connection attention is called to the report of Hon. D. P. R. Isenberg, the District Forester.

### MOLOKAI.

The native forest on Molokai is found at the east end of the island, at the higher elevations and along the precipitous palis on the windward side. That in the central portion and at the eastern end is in part protected from cattle by fences built and maintained by the Molokai Ranch Company. Between eight and ten thousand acres are enclosed—but not all of this is under forest cover.

On the leeward side of the island the Algaroba forest is spreading rapidly, both by extending along the shore and also by climbing up the slope—where it is now found as high as eighteen hundred or two thousand feet. The importance of a tree which forms such stands, and has so many uses as the Algaroba can hardly be overestimated.

Molokai is the only large island in the group which I have not

yet visited. Definite recommendations can therefore not be given here. The report of Mr. G. C. Munro, the District Forester for Molokai, should be read in this connection.

### LANAI.

The forest problem on Lanai is essentially one of protecting the remaining native forests against the destructive ravages of the goats, which now run wild in large numbers, over the rougher and higher parts of the island.

The great lack on Lanai is water. Were the water-sheds on the mountain covered more completely with forest than they are now, a larger water supply could be developed. For this reason I have recommended that the upper portion of mountain, which occupies the center of the island, be reserved and fenced off, and the wild goats systematically and thoroughly hunted down and exterminated.

The entire island is controlled, through direct ownership or through lease, by Mr. Charles Gay, who uses it as a cattle and sheep ranch. As he would be the one primarily benefited by the proposed forest reserve, it is only fair to look to him for liberal assistance in whatever work is undertaken. That a start ought to be made speedily there is no question, for the destructive erosion of the mountain caused by the goats, is becoming more and more serious every month that it is allowed to go on.

It is hoped that the coming year may see something accomplished.

### KAHOOLAWE.

Kahoolawe is said, in former times, to have been covered with forest. At present it is a bleak and wind-swept spot, from which the scant vegetation cannot prevent a constant cloud of sand and dust from being blown away to sea. It is used as a sheep ranch. Algaroba has made a good start along the beach and is spreading inland. Experiments with various trees, grasses and shrubs are being made by Mr. Christian C. Conradt, the lessee of the island.

## MAUI.

Maui is in some ways the most interesting island of the group from the forester's standpoint; for no where else in the Territory is the influence of the forest so well understood and its relation to the welfare of the community so clearly manifest.

The great Wailuku Plain, made fertile to a remarkable degree by irrigation, is the strongest sort of an argument for the safeguarding of the forests, from which comes the water that makes irrigation possible.

### *Hamakuapoko, Hamakualoa and Koolau.*

So alive to the importance of the forest for this purpose are the men controlling the agricultural land, that practically all of the forest land in the Districts of Hamakuapoko, Hamakualoa and Koolau, both public and private, is by arrangement with the Government, to be set apart as a great forest reserve.

Upon the government lands being reserved, the "Baldwin Interests" will turn over their forest lands as well, so that the reserve will be administered as a united and organic whole.

The details of this negotiation are well in hand and by the time this report is published the reserve will probably be proclaimed. The proposed reserve will include the bulk of the existing forest on the windward side of the island and will be one of the largest and most important in the whole Territory.

For a number of years portions of the proposed reserve have been maintained under fence as private reserves and cattle excluded from them.

Furthermore the Baldwin Interests have recently built long stretches of a forest fence along the lower edge of the forest in the Koolau District, on land which is leased from the Government, either as a whole or for the water rights only. This fence will, much of the way, be the lower boundary of the proposed forest reserve.

The public spirit and far sighted interest in the welfare of the Territory shown by Mr. H. P. Baldwin in his dealings with the Government in these matters deserve the highest commendation. The Territory is in need of more men like him.

### *Hana, Kipahulu and Kaupo.*

The necessity for forest protection also exists in these districts and later it will be advisable to extend the Koolau reserve along the Coast, or rather, make other reserves in these districts.

As yet I have only visited this section on a preliminary trip so that no definite recommendations can be given here as to what ought to be done.

### *Kahikinui.*

The forest problems in Kahikinui are largely those of reforestation and as such must necessarily wait till the reserve policy of the Government is well established and on its feet. The district is more recent geologically than the remainder of Maui and in consequence contains much waste and barren land.

### *Kula.*

On the southwest slope of Mt. Haleakala is a section which in former years was densely wooded but from which the forest has now almost wholly disappeared.

This area extends from the upper edge of the corn belt, up to the top of the long ridge that divides Kula and Kahikinui. From the evidence obtainable there is good reason to believe that were this area again in forest, conditions in the Kula district would be bettered in a number of ways. The problem presented is one well worth thorough investigation, and should be given careful and detailed study on the ground. As such a study has not yet been made, definite recommendations cannot be given here.

### *Tree Planting by H. P. Baldwin.*

No forest description of East Maui, be it ever so brief,, would be complete without some mention of the forest plantations which have been made under the direction of Mr. H. P. Baldwin and of other members of the Baldwin family. For many years systematic planting has been carried on on a large scale, with the result that a considerable acreage is now covered with forest. A great variety of trees have been experimentd with and many

valuable facts found out in regard to the kinds of trees best suited to the local conditions and to the methods which should be pursued to get the best results. It is hoped that in the near future these data can be compiled by the Division of Forestry, in cooperation with Mr. Baldwin, and made available for reference.

Plantations have also been made by the Maui Agricultural Company and the Haleakala Ranch Company, which deserve more space than can here be given them.

These forest plantations, with those of the Lihue Plantation Company, on Kauai, stand out as the leading examples of privately established forests in the Territory. They are examples which other companies would do well to imitate.

In his report as District Forester of Makawao, Mr. L. von Tempsky gives much interesting information in regard to this and other forestry work undertaken in his district. His report should be read in this connection, as should also that of Mr. H. A. Baldwin for his district.

### *West Maui.*

The West Maui Mountain is another section where there is need of forest reservation, as from this section, also, water is being developed for irrigation.

The Pioneer Mill Company has fenced off as a private forest reserve, the area on the Lahaina watershed, above the two thousand-foot contour line. Since cattle have been kept out the cover of vegetation has noticeably increased and demonstrated the effectiveness of the reserve. In this connection attention is called to the report of the District Forester for Lahaina, Mr. L. Barkhausen.

On the eastern slope of the West Maui Mountain the Wailuku Sugar Company anticipates doing work of a similar character, but as yet no active steps have been taken. This section is one which I have in mind to visit at an early date, to get in touch with the conditions on the ground and to make recommendations as to the forest areas which should be reserved.

## HAWAII.

The wide range of conditions on the Island of Hawaii gives rise to a variety of forest problems which can be best considered by individual districts.

## *Kohala.*

Nowhere in the Territory is there more pressing need of forest reservation than in this district, for on the forest area on the Kohala Mountain depends the chief water supply of the north end of the island. To insure its permanence this forest ought to be reserved at once.

The Kohala Reserve should include practically all of the existing forest on the south and west sides of the Kohala Mountain, and also a section above the plantations on the windward side of the district, as a water supply is needed both for the agricultural lands near the sea and for the development of the Waimea Plains, which might be made a region of farming lands and of diversified industries. Within the last few years land on and adjacent to the Kohala Mountain has been opened, in which cattle ought never to have been allowed. Unless these areas are reclaimed speedily it will be too late, for the forest is fast disappearing.

Various causes have operated to prevent forest reservation; the latest being the litigation now going on over the control of the Parker Ranch. But for this a considerable area of the Kohala Mountain would without doubt, by now have been a forest reserve.

Negotiations are now in progress with the owners of lands other than those controlled by the Parker Ranch, which ought to be reserved as forest and the whole matter will be steadily pushed and every effort made to establish the reserve.

Mention ought to be made in connection with this district of the spread of the Algaroba along the leeward coast from Mahukona to Puako. Within a few years there will be a dense stand of this valuable tree along this stretch of shore.

Considerable work had been done in the Kohala District in the way of establishing forest plantations and in experimenting with trees which are believed to be adapted to different situations and elevations. In this work Dr. B. D. Bond, Mr. E. E. Olding, Manager of the Kohala Sugar Company, and the Parker Ranch have taken the most active interest.

For the details of this work and other forestry matters the reports of the District Foresters for Kohala, Messrs. E. E. Olding and F. W. Carter, should be read.

*North Hamakua.*

The north end of the Hamakua District, between the Kohala District line and the Waipio gulch, an area of seventeen thousand acres, was set apart by Governor Carter as a forest reserve on December 23rd, 1904. The object of this reserve is to protect the watersheds of the streams rising in this section, the water and power from which are soon to be developed. Some additional lands now under private ownership ought also to be included in this reserve, as well as the adjoining section in Kohala. Negotiations looking to this end are now under way with the owners of these lands.

*South Hamakua.*

The forest above the agricultural land in the south end of this district has, through one cause and another, been gradually pushed further and further back up the mountain, and down from the upper side, until a point has been reached where any additional clearing will materially affect the already uncertain and intermittent streams; for in this end of Hamakua none of the streams run permanently. The question of an ample water supply is therefore a serious one.

As no detailed study of Hamakua has yet been made by me, recommendations cannot be given here. But there is no question in my mind that a belt of forest above the plantations ought to be reserved. A start toward this has been made in the tract of forest land above Kukuihaele now held as a private reserve. An examination of the South Hamakua District will be made in the near future, which it is expected will lead in the end to tangible results in the creation of a forest reserve.

For almost twenty years tree planting has been going on in Hamakua, with the result that there are now considerable areas covered with artificially established forest, as well as many miles of wind breaks and rows of shade trees along the roads and on the several plantations.

Much of this work has been done at the instance or following the example of Mr. David Forbes, the District Forester. In his report will be found many pertinent observations on the kind of trees which have been found to do well in his district, with other matters of interest concerning forest matters.

## *Hilo.*

A carefully worked out plan for a forest reserve has been prepared for the Hilo District, including the area between the Hamakua District line and the 1855 and 1881 Lava Flows, back of Hilo town. The lower limit of this proposed reserve is at an elevation of approximately seventeen hundred and fifty feet and its upper edge is along the upper edge of the Koa and Ohia forest, at an elevation of about six thousand feet. An accurate map on a large scale showing the lower boundary has been prepared for the Board by Mr. A. B. Loebenstein of Hilo. Another map of the upper boundary is almost ready. Upon its completion the matter will be brought up to the Governor with the request that the government forest lands within the boundaries of the reserve be set apart. A large percentage of the land within the proposed reserve is owned by private interests, and some of it is now held as private forest reserves. Negotiations are under way whereby these lands may, under the law, be included in the proposed reserve.

It is hoped that in the future considerable work may be done toward the afforestation, with timber trees from the temperate zone, of the high lying slopes of Mauna Kea, above the level of the good grazing land. Experiments to that end are now being made, which it is expected will yield valuable data for future work.

### *South Hilo and Puna.*

The sudden change of conditions found on crossing to the East of the 1881 Lava Flow renders the forest problems of South Hilo and of Puna of less immediate importance than those in the North end of the Hilo District.

South Hilo is a district of heavy rainfall but the porosity of rock and soil makes running streams out of the question and as there is no barrier reef along the Puna Coast, to hold back the ground water and supply artesian wells, this necessity for protecting the watersheds does not exist. At the same time the rough and rocky character of the land makes much of it suitable only for forest. No detailed examinations have yet been made in either of these districts, consequently no recommendations are given here. But it is believed that there are certain areas, which

being chiefly valuable because they can be made to produce trees of commercial importance, ought to be used by the Government for this purpose.

The forest question in these districts is essentially one of the commercial value of the forest products. If it can be shown that for certain tracts the best crop is trees, then the land should be so used.

Attention is here called to the report of the District Forester, Mr. John Watt.

## *Kau.*

### East Kau.

In parts of Kau, especially at the eastern end of the district, the same conditions obtain as in Puna. The porous character of the soil makes permanent streams impossible and watershed protection unnecessary. The commercial aspect of the forest therefore becomes the dominant feature, and as there are in this section considerable areas covered with the most valuable Hawaiian wood, Koa, it becomes a business proposition of how to make this asset a tangible one. The policy of logging the mature and merchantable trees of commercially valuable species is good sense and good forestry; provided the work is done with due regard for the young trees that are to make the succeeding stand. To cut the mature trees in such a way as to insure the permanence of the forest is indeed the keynote of forestry. In the epigram of President Roosevelt, "Forestry is the preservation of forests by wise use."

The Division of Forestry is now cooperating with the Bishop Estate in preparing plans whereby a section of Koa forest of the above character may be lumbered in accordance with forestry methods. These plans if put into effect will mark the beginning of practical forestry in the utilization of the Hawaiian forests.

In considering this district it may be noted that the Bishop Estate maintain some forty-five hundred acres of the land of Keauhou, as a private forest reserve, from which stock are excluded.

The ultimate afforestation of the upper slopes of Mauna Loa, as well as those of Mauna Kea is a part of the general plan of

the Division of Forestry, but as this work must necessarily wait for the present, recommendations concerning it would be out of place in this report.

### West Kau.

In the other end of the Kau District the forest problems are of a different character. Here it has been proved possible to develop water by the aid of the forest; springs and brooks yielding a regular supply when their sources are protected by a forest cover.

Messrs. C. Brewer and Company, largely at the instance of Mr. George H. Robertson, and Mr. Julian Monsarrat, have for a number of years kept fenced in and protected from cattle, a private forest reserve of some twelve miles in length, by from three to four miles in breadth, containing 25,000 acres, more or less. From this area enough water has been developed to carry on successfully a large sugar plantation.

Other interests in Kau, particularly the Hutchinson Plantation Company, are desirous of extending this reserve or making other similar ones, with government cooperation. The investigations on the ground which will lead to recommendations in regard to these proposed reserves will be made as early in the coming year as circumstances permit. It is an important question and should be taken up as soon as may be.

Another large problem which awaits solution in Kau is the clothing of the barren lava flows with vegetation. It is hoped that when the more pressing work of establishing forest reserves is accomplished this subject can be tackled. It offers many difficulties but is for that reason all the more worth while.

Attention is called to the reports of Messrs. Julian Monsarrat and Geo. C. Hewitt, the District Foresters for Kau.

## *Kona.*

The district of Kona embraces so large an area that it can best be considered by sections.

### South Kona.

South Kona from the Kau boundary to and including the land of Honokua is a region of comparatively recent origin.

While not as young geologically as parts of Kau it yet contains many square miles of rough "a-a," and fields of "clinkers" but scantily, if at all, covered with vegetation.

Among the rocks, however, are pockets of rich and very fertile soil, so that in limited areas almost every kind of valuable plant, suited to this latitude and climate, can be made to grow luxuriantly. But unfortunately for the producer the market is limited and far off and the cost of transportation high.

There is much forest in this section and some of it would be of no small commercial value were there a better chance of getting out the lumber. At present only a few trails penetrate the forest, making but a narrow belt along the Government road accessible. Beyond this the country is practically unknown. Matters in South Kona would be greatly simplified if a classification of the Government land into its several classes were made, when an intelligent plan of development could be formulated. Were this done there would be found many areas of lava too rough for any sort of agriculture, or even grazing, which might be made to produce trees. In my judgment all of the land in South Kona which can be developed ought to be thrown open while the remaining a-a and clinker fields, should be left in forest. Further recommendations are unnecessary at this time.

Mr. Franz Buchholtz, the District Forester for South Kona, has for some years carried on valuable experiments in tree growing in this district. In his report will be found some account of them, with other pertinent observations. His report should be read.

## Middle Kona.

The stretch from the land of Honokua to the old Judd road, or to the lands of Holualoa, may be called Middle Kona. It is essentially an agricultural section, which is and should be devoted to the various "diversified industries."

Above the agricultural land and stretching well up onto the slope of Mauna Loa is a belt of forest. It is a mixed forest of the usual Hawaiian type, in which Ohia Lehua and Koa predominate. The lower edge varies from 2500 to 3000 feet in elevation and the forest runs out at about 6000 feet. Portions of this forest belt have been used for many years as grazing land and the forest there, as might be expected, is open and without

undergrowth or young trees. Elsewhere it has been protected from cattle and is a dense and impenetrable jungle. Notable in this connection is the private forest reserve made by the Bishop Estate on the lands of Kahauloa 2, Honaunau and Keokea. This area covers about 11,600 acres and has been fenced against cattle for a number of years.

The effect of the belt of forest above the settlements in Kona upon the general welfare of the district is hard to determine, but it may safely be said that a conservative policy in its management is to be preferred to one which will lead to a decided reduction of its area.

The ownership of by far the larger part of Kona rests in individuals or corporations, so that the Government can only act in an advisory capacity. The present policy of unrestricted grazing in the forest belt can but result in the long run in reducing the forest area. The question for the large owners to determine is, "How far can this reduction go on without detriment to our other interests?"

The Government also is interested in the question in a larger way because of its bearing on the welfare of the community for all time.

In answering these questions, the Division of Forestry stands ready to help, so far as it may, by studying the problems on the ground, in detail, and by recommending what in each case is believed to be the right course to pursue. The Bishop Estate has taken the lead; will the other interests follow?

While not strictly a forest cover, it may be noted here that the Lantana has spread in late years over a large area of low lying lava land in Middle Kona. A noticeable change in the climatic conditions is said, by the people living in the district, to have followed this covering of the easily heated rock by a coat of cool vegetation. Light clouds which formerly passed over are said to now drop their contents at the lower levels, the showers so resulting adding materially to the comfort and welfare of the district.

This is an interesting example of the sort of influence which a forest tends to exert, only in a more perfect way and on a larger scale.

It may be noted also that the Algaroba is spreading along the Kona coast, as it is on the leeward side of the other islands.

Within a few years there will be a noticeable difference in the appearance of this coast.

The report of the Hon. J. D. Paris, the District Forester for Central Kona, should be read in this connection.

### North Kona.

By North Kona is meant that part of the Kona District north of the old Judd road. This section is notable from lying practically altogether on the sides of Mt. Hualalai, which rises to an elevation of 8,269 feet.

On the north and west sides of this mountain, at an elevation of from 4,000 to 5,500 feet is a belt of Koa forest which is potentially of no small value. I have already recommended that as much of it as is on Government land be set apart as a forest reserve. Later when the expected market has developed it should be lumbered under the conservative methods of practical forestry and thereafter be made to yield subsequent crops of valuable timber at regular intervals.

As the forest hereabout contains springs capable of development, I further recommend that this reserve be extended to include and protect their sources. It should be distinctly understood that the reserve here proposed is above and outside of the land suited for settlement.

For some years a private forest reserve has been maintained by the owners of Puuwaawaa Ranch, on the land of that name leased from the Government on the northern slope of Mt. Hualalai. This forest which contains some of the Koa described above, ought to be continued as a forest reserve, and later formally set apart.

The report of Mr. J. A. Maguire, the District Forester for North Kona, should be read in connection herewith.

## Other Work of the Division of Forestry.

### THE GOVERNMENT NURSERY.

Although the main efforts of the Division of Forestry during the past year have been directed toward the establishment of forest reserves, other lines of work have, so far as the limited

appropriation allowed, also been carried on. Chief among these is the Government Nursery. This may well be considered by the four sections into which the work is naturally divided; Plant Distribution, Experimental Work, Seed Collection and Advice and Assistance.

From July 1st to October 9th, 1903, Mr. C. J. Austin was in charge of the Nursery. He was then transferred to the Division of Entomology, being succeeded as Gardener by Miss Clare M. Kelley. Miss Kelley gave faithful and intelligent service until June 10, 1904, when lack of funds prevented her further employment. Since that date Mr. David Haughs has been in direct charge of the Nursery, having been transferred from the Nuuanu Forest Station, where he had been located for some time.

On September 30th, 1904, the Japanese laborers at the Nursery and the Nuuanu Station, some of whom had been employed for seven or eight years, were discharged in accordance with the Citizen Labor Law, their places being taken by Portuguese. Owing to the higher wages paid to the new men the number of laborers was reduced from eight to five.

*Plant Distribution.*

The present year has been marked by a change of policy in the manner of running the Nursery. Instituted at a time when there was real need for beautifying Honolulu, the free distribution of ornamental shrubs and plants had assumed such proportions as practically to exclude other uses. Furthermore it had come to pass that the free distribution hardly reached beyond Honolulu.

Feeling that the Nursery should be devoted primarily to the growing of forest trees and to experimenting with new or little known trees and shrubs, I recommended early in the year that the free distribution be discontinued. In this I was further influenced by the necessity for retrenchment due to the existing financial stringency, as well as by a desire not to compete with commercial nurserymen who were or might be doing business in the Territory.

Accordingly, by direction of the Board, the free distribution was discontinued and the ornamental stock on hand closed out.

Since May the trees, plants, and seed in the Nursery have been on sale at prices just covering the cost of growing or collection.

The Nursery is now run with the object of supplying forest and shade trees at cost, to any one who may desire them and of keeping on hand good seed of the important native and introduced trees and shrubs. Schools and public institutions are still supplied free, upon application, and a limited number of palms is kept on hand for this use. Details of this section of the Nursery work will be found in the report of the Field Foreman.

### *Experimental Work.*

The experimental work during the past year has consisted for the most part of trials of exotic seed at the Nursery and at selected points on the other islands, and of germination tests at the Nursery of seed collected locally. The Division of Forestry is in correspondence with men and institutions throughout the world and by exchange and purchase this branch of the work will be carried on.

There is room as well for experiments in methods of propagating new trees and shrubs, other than by seed, which it is hoped may later be taken up.

Under the head of experimental work may also be classed the gathering of scientific data, such as notes upon the times and period at which the trees in and around Honolulu are in flower and fruit. Systematic notes are being kept which in the end should yield valuable information.

### *Seed Collection.*

The collection of seed, both of native and of introduced trees, is one of the most important branches of the Nursery work. It is the intention to have on hand, and for sale, at prices just covering the cost of collection, seed of all the trees which can be recommended for use in the different parts of the Territory. The seed kept on sale is carefully tested and will be warranted pure and fresh. Owing to this branch of the work having been hampered by lack of men to do the collecting, not as large a stock is now on hand as could be wished, but every day adds to the collection and soon the Nursery will be able to supply all reasonable demands.

*Advice and Assistance.*

Another way in which the Division of Forestry is of value to the people of the Territory is through the advice and assistance which it is prepared to give upon application, to those who wish to manage their forest land in accordance with the principles of practical forestry, or to establish plantations of forest trees.

The only formalities attending this offer are that requests shall be made in writing and that the traveling expenses and subsistence of the agent, during the visit, shall be paid by the applicant. In giving its advice the Division of Forestry reserves the right to make public such facts and figures in regard thereto as it may deem proper.

As yet the assistance given has been for the most part confined to places in and near Honolulu, the advice sought being mainly in regard to the planting of street and shade trees.

A little later when more men and money become available, it is hoped to make this one of the principal lines of work of the Division. It is probable that the National Bureau of Forestry will be able to help the Division in this particular.

In standing ready thus to assist the private owner, by showing him how to go about his forestry work and by furnishing him good seed at cost, I believe that far better and more lasting results will be attained than were possible under the indiscriminate free distribution of the past.

NUUANU FOREST STATION.

The work at the Nuuanu Valley Forest Station has also undergone modification during the year. Although of much interest, the results being obtained did not in my judgment justify the outlay. Until it is more definitely known how the various trees being used will act under given conditions, extensive planting seemed to me unwise. The planting of new areas was therefore discontinued.

The plantations already made are being cared for and protected, and careful record is being kept of the trees in them, to find out which kinds are doing the best. With the experience thus gained as a guide, if it is later found advisable to resume planting, it can be undertaken with a good chance of success.

Special attention is called to the accompanying report of Mr. David Haughs, Field Foreman of the Division of Forestry. In it will be found a discussion in detail of the several sections of the Nursery and Nuuanu Station work outlined above.

### OFFICE WORK.

The routine work of the Division of Forestry was, early in the year, systematized and made effective. In March a Globe-Wernicke Vertical Filing Cabinet was installed, in which the correspondence and reports of the Board and of the Division of Forestry are filed, according to the numerical vertical filing system, the most convenient and up to date system of loose sheet filing now known.

The correspondence of the Division of Forestry is rapidly increasing, so that all helps of this sort are not only useful but essential.

A mailing list, made up of the names of persons throughout the Territory, who are or should be interested in forestry, has been compiled.

Collections of maps of forest and other lands, of forest photographs, and of forest statistics and other data have been started, and will be added to as opportunity offers.

Mention may well be made here of the painstaking and conscientious work of the Board's stenographer, Miss Melika Peterson. Had it not been for her interest and devotion to her duties, the routine work of the Board and of the Division of Forestry would have been seriously hampered.

### HERBARIUM.

An Herbarium has been begun, which it is hoped will in time include specimens of all the aborescent plants in the Territory, both native and introduced, as well as of other plants which are of economic importance. The value of such a collection, properly labelled and described, is hard to overestimate.

### MUSEUM.

The Board was fortunate in falling heir to the collections of native Hawaiian woods and of the various fruits grown in the Territory, intended for the Exposition at St. Louis, but which from lack of funds could not be sent.

The logs have been cut and polished in the same manner as are the specimens in the Morris K. Jessup Collection of American Woods, in the Museum of Natural History, in New York City. The collection number sixty-three specimens of forty-four varieties of island woods.

The fruits are to be placed in special exhibition jars, where they will show to advantage.

These exhibits are being installed in the Museum room in the Board's building and will be open to the public early in January.

### LIBRARY.

At the meeting of the Board held on March 9, 1904, I was requested to take charge of the library of the Board. The report of the library for the past year may therefore perhaps best be included here.

Soon after his arrival in the Territory, in July, 1903, Mr. G. W. Kirkaldy (now of the Hawaiian Sugar Planters' Association Experiment Station) undertook the arrangement and classification of the books and other publications belonging to the Board, and by the time of the Bureau's removal to its new and commodious quarters, had evolved system out of a veritable chaos. Through the efforts of Mr. Kirkaldy and of myself, the Library has received many additions through gift and exchange, and is now in the way of getting most of the publications dealing with agriculture in its broadest sense, which can be had free from the Federal Government, the several States, and a number of foreign countries.

Some few forestry and rather more entomological books have been purchased during the year, but limited means have prevented the addition of any considerable number. This is most unfortunate because there are many books, especially on botany and entomology, which are imperatively required for the proper carrying on of the regular work of the two Divisions. It is sincerely hoped that a considerable sum can be devoted to the purchase of books the coming year.

Of the publications that have been bought during the last year special mention may be made of the "Index Kewensis," Bentham and Hookers' "Genera Plantarum," and complete files of the "Zoological Record" and the "Canadian Entomologist."

As the law creating the Board, makes mandatory the main-

tenance of a library, this library has come to be regarded as the Department of Natural Science of the Library of the Territory. By direction of Governor Carter all books in his office and in the Archive Room at the Capitol, dealing with the subjects which come under this general head, have been turned over to the Board for custody and safe-keeping.

The Hawaiian Live Stock Breeders' Association has also deposited its library with the Board, pending such time as the Association may have rooms of its own. This collection is kept in a separate case, but is open to the public.

A regular card catalogue, by subject, author and title has been begun and will be pushed as rapidly as may be, while a system of keeping track of accessions by means of a card catalogue has also been started.

The Federal, State and other publications have been systematically arranged on shelves in the Board room, and the library is open to the public for reference, daily, during office hours. As the library increases in size and becomes better known, it is hoped that it will be more and more consulted. No formalities attend its use.

### GROUNDS.

The grounds of the Government Nursery have been much improved in the past few months by the removal of many trees and shrubs of minor value, by the planting of grass and by a general cleaning up. Labels bearing the scientific and common names are, or will soon be, attached to each tree. In this way a start is being made toward an aboretum; which it is hoped may some day result in a systematic collection of growing specimens of the native and introduced trees and shrubs. Such a plantation could well be made along the road through the forest on Mt. Tantalus.

### OTHER FORESTRY MATTERS.

Mention has already been made of the publication by the U. S. Bureau of Forestry of Bulletin No. 48—"The Forests of the Hawaiian Islands," by William L. Hall.

During the year numerous reports of mine upon various forestry subjects have appeared in the Hawaiian Forester and Agriculturist, the official organ of the Board, and in the local

newspapers. No bulletins or circulars have yet been issued by the Division of Forestry.

Continued correspondence has kept the Division of Forestry in close touch with the U. S. Bureau of Forestry at Washington. Mr. Gifford Pinchot, the Forester, has repeatedly expressed his interest in the work here and various members of the Bureau staff have been of assistance in one way or another. All this results in no small benefit to the Division.

Among the many visitors to Honolulu during the past year there have been some foresters. Captain George P. Ahern, Chief, and Mr. Ralph C. Bryant, Assistant Chief, of the Philippine Bureau of Forestry, have both passed through town, while several other men connected in various ways with forest work in different parts of the world have called at the office. Personal contact of this kind is of importance in questions of exchange and co-operation which may later come up.

As custodian of the building it may not be out of place to mention here that the Library, or Board room, was on November 10th and December 21st, 1904, used for forest reserve hearings, held by the Governor and the Board.

The room has also been twice used, on April 23rd, and on December 12th, 1904, for public meetings of the Farmers' Institute of Hawaii. It is hoped that the use of the building for such purposes will continue and increase.

### PLANS FOR THE COMING YEAR.

The work for the Division of Forestry for the coming year will in general be similar to that of which this report tells, but with certain important additions.

The creation of forest reserves will hold first place, as it has this year; the pending forest reserves in Koolau and Hamakualoa, Maui, Hilo, Hawaii, and Halelea, Kauai, being followed by investigations and reports with recommendations, on forest land elsewhere in the Territory.

Among the places which should be taken up in the near future, as being in perhaps the most immediate need for forest protection, are the Kohala and South Hamakua districts on Hawaii, the West Maui section on Maui, the Ewa and Waialua Basins on Oahu, and the districts of Puna and Kona on Kauai.

Portions of Kau on Hawaii, Kula on Maui, and the Waianae Hills on Oahu also deserve early attention, as do some parts of Molokai. There is no lack of work to be done; the principal reason why some of it should come sooner than the rest being that in a section like Kohala, unless something is done in very short order the time for saving the native forest will have passed.

With the creation of forest reserves the necessity for establishing a system of administration becomes paramount.

In the reduction of the appropriation last spring the amounts to be devoted to this use fell out altogether. As no reserves had at that time been set apart, this was then perhaps as good a place as any at which to retrench, but with the creation of the several reserves, which are now practically assured, the case is now a wholly different one.

To secure an effective system of forest control takes men. Without such a system the value of forest reserves is very seriously lessened. It is therefore imperative that the organization of a forest ranger service be made a prominent feature of the forestry work of the coming year.

The various other branches of forestry work will be continued during the coming year as far as men and means allow, especially the work classed as Seed Collection and Advice and Assistance. Mr. Pinchot has promised to send a man to help in the latter work, whenever one is available. It is probable that such an assistant can be expected during the coming year.

With the more important lines the experimental work will be kept up and the herbarium and other collections added to, as opportunity allows.

The widespread sentiment in favor of forestry which exists throughout the Territory makes the outlook an extremely favorable one, and with an appropriation by the Legislature of an amount which the importance of forestry work in the Territory justifies, the coming year ought to be one notable in the annals of forestry in Hawaii.

Respectfully submitted,

RALPH S. HOSMER,
Superintendent of Forestry.

# REPORT OF DAVID HAUGHS, FIELD FOREMAN, DIVISION OF FORESTRY.

HONOLULU, T. H., Dec. 31, 1904.

RALPH S. HOSMER, ESQ.,
Superintendent of Forestry,
Honolulu.

DEAR SIR:—I herewith submit a report of the work done at the Government Nursery and at the Nuuanu Forest Station from July 1, 1903, to December 31, 1904.

## NURSERY.

### *Plant Distribution.*

Previous to October 9th, 1903, Mr. C. J. Austin was in charge of the Nursery, during which time no plants were given out on account of the prevalence of insects and blights.

On October 9th, 1903, Miss Clare M. Kelley was appointed Gardener and served until June 19, 1904, when the writer was transferred from the Nuuanu Valley work and put in charge of the Nursery.

Up to December 29th, 1903, plants were distributed free to the public. By a motion passed at a meeting of the Board of Commissioners of Agriculture and Forestry, held on December 29th, 1903, it was decided to offer the plants on hand for sale at a nominal figure.

Since the above date, a charge has been made on plants, the following public institutions, however, being still left on the free list: Churches, schools, court-houses, parks, etc.

The following table shows the number and kind of plants distributed to the several islands; from October 9th, 1903, to date.

TABLE SHOWING DISTRIBUTION OF PLANTS FROM THE GOVERNMENT NURSERY, OCTOBER 9, 1903, TO DECEMBER 31, 1904.

| | Forest Trees | Fruit Trees | Ornamental Plants |
|---|---|---|---|
| Given away | 4,023 | 1,548 | 5,494 |
| Sold | 3,271 | 34 | 84 |
| | 7,294 | 1,582 | 5,578 |
| Grand Total | | | 14,454 |

The sale of plants has resulted in receipts of $630.68, which has been paid into the Treasury as a realization.

Owing to the limited help we have at our command at present, the work of the Nursery is hampered in all lines. Since October 1st three men only, could be employed; one man acting as janitor, also attending to the horses and driving wagon; one collecting seeds, cleaning up, etc., in Nursery; one attending to plants, irrigating, etc. These men have also to work for the Division of Entomology when required.

## EXPERIMENTAL WORK.

### *Experiments With Exotic Seeds.*

A consignment of seed ordered from India by Commissioner W. M. Giffard and received October 13th, 1904, has done as well as could be expected. The *Albizzia stipulata, Tectonia grandis, Corchorus olitorius* and *Mimusops,* arrived in good contion. The *Cochorus olitorius* (Jute) after being tested was handed to Mr. Jared G. Smith, as we had no land suitable for experimenting in Jute. The others are doing well.

Another package of seed presented to the Division of Forestry by Commissioner Giffard, who received the same from Mr. Thomas H. Sedgwick, late of the U. S. Experiment Station, and now in Peru, has done exceedingly well. The name on the package was "paipai," which is probably a native name. A search in our botanical books failed to find this name. Mr. Sedgwick says, "the tree is used in Peru for the same purposes as the *Proposis juliflora* (Algaroba) is used for here."

Another important introduction presented to this Division by Commissioner Giffard is a new Algaroba *Prosopis pubescens* (Tornillo or Screw Bean). The beans of this tree have proved by an analysis to be richer in saccahrine matter than our *Prosopis juliflora* (Algaroba). The seed was received on December 6th and sown the same day. They started to sprout two days later.

The following seeds handed this Division by Commissioner Giffard were collected by the late S. T. Alexander in South Africa. They were received December 7th and sown on the same day:

1 package *Erythrina tomentosa.*
1 " Mlangi Cedar.
1 " *Coffee robusta* var *Uganda* (Native coffee).
1 " *Pandanus* sp. (Collected at Lake Myanza.)
1 " *Solanum robustum.*

The following seeds were received from Professor Koebele, on Sept. 21st, and sown the same day:

1 package Queensland Bean tree.
1 " *Ptychosperma cunninghamia.*
1 " Queensland Plum.

None of these have sprouted so far.

From Mr. G. N. Wilcox of Kauai, we received a large quancity of *Ceritonia saliquay* (St. John's Bread) seeds. Also from Mr. Wilcox came fruit and seventeen seeds of the Durian tree. Every one of these seeds sprouted and they are all doing well.

Seeds of trees and shrubs from the Western United States, especially California, have been received through the courtesy of the Bureau of Forestry and the Pacific Coast Laboratories of the Bureau of Plant Industry, both branches of the U. S. Department of Agriculture.

Some of these seeds have been tried in the Nursery while others have been furnished to district foresters and others to be tried at higher elevations, elsewhere in the Territory.

In this connection a shipment of coniferous seed from the Southern Californian Mountains, sent by Mr. T. P. Lukens of Pasadena, California, should be noted.

The experimental work of the Nursery also includes the propagation of aborescent exotic plants, new or little known

in these islands, and experiments in budding and grafting fruit and other trees. A wide field of work is open in this direction, were men and funds available, with which to carry it on.

### COLLECTION AND DISTRIBUTION OF SEEDS.

The seed collecting has been done mostly around Honolulu. Tantalus has supplied the majority of the forest tree seed, while seed of the shade and ornamental trees has been collected in Honolulu. Great care has been taken in collecting from the most healthy and mature trees, so that the best results might be obtained. Seed received from abroad is tested before being distributed to the public, so that people ordering seed from this Division can rest assured that they are getting the best and freshest seed that can be obtained. With ordinary care there ought to be no trouble in making a success in raising it.

Only the actual cost of collecting and sorting is charged. By comparing the prices with those on the coast or foreign countries it will be found that there is a large discount in favor of dealing with the Division of Forestry.

Another point to be considered in dealing with this Division is that the seeds collected here are from trees that are acclimated and have done well in these Islands and are thus likely to make a faster growth than the same kinds imported from abroad. We would therefore urge that people contemplating tree planting on a large or small scale first consult the Division of Forestry instead of wasting time in experimenting with new and untried species.

On our exchange list we have among others the U. S. Bureau of Forestry, Washington, D. C.; Bureau of Forestry, Manila; Public Works Department, Guam; Pacific Coast Laboratories; Dr. John Gifford, Cocoanut Grove, Dade Co., Fla.; Mr. T. P. Lukens, Pasadena, Cal., and Dr. C. A. Schenck, Forester, Biltmore Estate, Biltmore, N. C. We have forwarded seeds, and have received in return shipments of seeds or the assurance that seeds in exchange would be forthcoming from all the above. We are also in communication with most of the Botanical Gardens throughout the world.

TREES AND PLANTS ON HAND DECEMBER 31, 1904, FOR SALE AND FOR DISTRIBUTION.

*In Pots.*

| No. | Common Name | Scientific Name. |
|---|---|---|
| 150 | ..... | *Berrya ammonilla* |
| 100 | Ironwood | *Casuarina equisetifolia* |
| 700 | Lemon Scented Gum | *Eucalyptus citriodora* |
| 150 | Red Gum | *Eucalyptus polyanthema* |
| 800 | Swamp Mahogany | *Eucalyptus robusta* |
| 2200 | Silk Oak | *Grevillea robusta* |
| 144 | Ohai | *Sesbania tomentosa* |

*In Boxes.*

| No. bxs. | Common Name | Scientific Name. |
|---|---|---|
| 20 | Ironwood | *Casuarina equisetifolia* |
| 6 | ..... | *Casuarina glauca* |
| 6 | Monterey Cypress | *Cupressus macrocarpa* |
| 1 | Java Plum | *Eugenia jambolana* |
| 2 | Lemon Scented Gum | *Eucalyptus citriodora* |
| 1 | Swamp Mahogany | *Eucalyptus robusta* |

TREES AND PLANTS ON HAND DECEMBER 31, 1904— IN EXPERIMENTAL PLOTS.

(Not available at present for distribution.)

| No. Pots | Common Name | Scientific Name | Locality received from |
|---|---|---|---|
| 90 | Mango | *Mangifera indica* | ..... |
| 500 | ..... | *Albizzia stipulata* | ..... |
| 16 | Durian fruit | *Durio ziebethinus* | ..... |
| 90 | "Paipai" | ..... | ..... |
| 12 | Teak | *Tectonia grandis* | India |
| Bxs. | | | |
| 2 | European Chestnut | *Castanea sativa* | ..... |

| No. Pots | Gommon Name | Scientific Name | Locality received from |
|---|---|---|---|
| 2.... | Jaya | ..... | Peru |
| 1.... | ..... | *Erythrina tomentosa* | S. Africa |
| 1.... | ..... | *Pandanus* sp. | S. Africa |
| 1.... | Mlangi Cedar | ..... | S. Africa |
| 1.... | ..... | *Solanum robustum* | S. Africa |
| 2.... | Screw Bean | *Prosopis pubescens* | Arizona |

About 1000 assorted plants ordered by public institutions remain in the Nursery.

### BOTANICAL WORK.

A commencement has been made on a table which will give the flowering season of all the indigenous and exotic plants now in the Territory. This work will have to be continued over several years so that as correct an average as possible may be made.

An herbarium of the arborescent flora has also been started, which will be added to as opportunity offers.

### ADVICE AND ASSISTANCE.

One of the duties of this office is to give advice in the propagating, planting and care of trees. During the period covered by this report twenty-seven persons have called for advice on the above subjects, and at the request of owners of lands ten visits have been made to as many tracts in and around Honolulu. By first visiting the tracts, when advice is asked, a more accurate and satisfactory statement can be made regarding the planting.

The principal information asked for in such case is as follows: "The best method of propagating seeds," "kinds of trees to plant," "size of holes," "distance apart," etc.

### PRIVATE NURSERIES.

Inquiries have been made from time to time of the different owners of private nurseries in the city regarding the class of plants they wish to keep in stock for sale, that such information

may be given to persons inquiring at this Nursery. It is the desire of the Board of Commissioners of Agriculture and Forestry to assist rather than infringe on the business of the private nurseries. This, indeed, is one of the reasons why the Government handles only such stock as forest and shade trees, the latter being in great demand in large quantities for road and street planting.

We would urge, however, that those desiring large quantities of forest or shade trees notify us several months in advance so that the trees required may be on hand when wanted.

Current seed and plant catalogues are also kept on file for the use of the public, who can have recourse to them at any time during office hours. They comprise catalogues from most of the leading firms in the United States, Australian Colonies, India, Ceylon, etc.

### NURSERY IMPROVEMENTS.

Owing to the crowded condition of the Nursery considerable thinning has been done. Unimportant and duplicate species have been removed and those left have been pruned, so that each species has now room to grow and show its characteristics to better advantage. Most of the shrubs, such as the Crotons, Hibiscus, Panix, etc., have also been removed. Grass has been planted where the dense shade kept it from growing before. Wooden curbing has been laid around three sides of the office building and plots at each end of the building and on the west side have been planted in grass. An eight-inch pipe has been laid to carry the roof and surface water away from the building. The King street gate has been changed so that it is now directly opposite the front door of the offices and the fence around the Nursery has been repaired and given a coat of green stain.

The planting of grass was done by a gang of prisoners sent by Mr. C. S. Holloway, Superintendent of Public Works, otherwise the work could not have been done owing to the limited help we have at our command. It is to be hoped that the prisoners will be allowed to come and assist in keeping the grounds in good condition.

A systematic and continued effort is being made to rid the Nursery of the "Nut grass" or "Coco" (*Cyperus rotundus*) which is one of the worst weed pests that can get into our gardens here.

Its presence in the Nursery has prevented the use of one portion of the grounds for experimental plots, through the fear that the weed might be spread if plants were sent out with soil adhering to their roots.

### TREES TO BE LABELED.

Labels are being prepared and each tree will soon be marked with its correct name, both common and scientific, so that with the use of the Library, which is open to the public, during office hours, a grand opportunity is offered for those interested in the study of Arboriculture.

That this opportunity is appreciated is proved by the number of visitors to the grounds, who have come primarily to see the trees and learn something about them.

### NUUANU FOREST STATION.

The following is a report of the work done at the Nuuanu Forest Station from July 1st, 1903, to December 31st, 1904.

The work has been divided as follows: Making leaf pots and transplanting, this work being done during heavy rains when the men could not work outside; clearing grass and vines away from young trees, rooting out Lantana, making holes and planting.

The number and kinds of trees planted out during the period are as follows:

During 1903:

| | |
|---|---|
| Australian Blackwood (*Acacia melanoxylon*) | 2,600 |
| Ironwood (*Casuarina equisetifolia*) | 2,000 |
| Silk Oak (*Grevillea robusta*) | 4,800 |
| Swamp Mahogany (*Eucalyptus robusta*) | 5,000 |
| Total | 14,400 |

Number and kinds planted during year 1904:

| | |
|---|---|
| *Acacia melanoxylon* | 980 |
| *Casuarina equisetifolia* | 2,696 |
| *Casuarina quadrivalvis* | 280 |
| *Casuarina tenuissima* | 750 |
| *Eucalyptus robusta* | 9,281 |
| *Eucalyptus calophylla* | 100 |
| *Grevillea robusta* | 1,724 |
| Total | 15,811 |
| Total for 1903-4 | 30,211 |

On March 16th, 1904, work was started on six experimental plots on close planting. The piece of land selected is on the Ewa side of Government road, about 300 yards below the lower end of the road which leads to quarters.

Six plots were made with a twelve-foot alley between the plots. Commencing from upper end, in Plot 1, 51x210 feet, the trees were planted 3x3 feet. Total trees in Plot: 1,190, planted in *Casuarina tenuissima.*

Plot 2, same size as No. 1, planted in *Eucalyptus robusta,* 1,190 trees.

Plot 3, 52x208 feet, trees planted 4x4 feet. Total number in Plot, 676, planted in *Casuarina equisetifolia.*

Plot 4, same size as Plot 3, planted in *Eucalyptus robusta,* 676 trees.

Plot 5, 50x120 feet, trees planted 5x5 feet, total number in Plot, 420, planted in *Casuarina equisetifolia.*

Plot 6, same size as Plot 5, planted in *Eucalyptus robusta,* 420 trees. This work was finished on May 14th.

A wind break nine feet high and one hundred and fifty feet long was made at a place where the trees had never done well owing to the exposed position, to see if after getting well started the trees could withstand the wind. Two hundred *Eucalyptus robusta* trees were planted behind this wind break 6x6 feet each way. This work was completed May 21st, since that time no planting has been done.

Previous to March 31st, 1904, eight men were employed, after which the gang was reduced to four. On May 5th, two

men were transferred to assist in the King Street Nursery, two being left at the Nuuanu Station. One man was returned to Nuuanu Station June 27th, and the three worked at the station until September 5th, when one man was again transferred to the King Street Nursery to assist in removing trees, etc. Since that time only two men have been employed at the Station, their work being caring for the trees that have been planted out, cutting and clearing away grass and vines, etc.

Very little can be said at this time about the trees on the experiment plots or behind the wind break as neither have grown large enough to receive the full force of the wind. At present they are all growing well and looking healthy.

The four kinds mentioned in previous reports as being the best are still holding that position against the many other kinds that have been tried in Nuuanu. Their names are as follows:

Australian Blackwood (*Acacia melanoxylon.*)
Ironwood (*Casuarina equisetifolia*)
Swamp mahogany (*Eucalyptus robusta*)
Silk oak (*Grevillea robusta*)

Respectfully submitted,

DAVID HAUGHS,
Field Foreman.

LIST OF FRUITS IN THE MUSEUM OF THE BOARD OF AGRICULTURE AND FORESTRY.

| Common Name | Scientific Name | Varietal Name (if any) |
|---|---|---|
| Apple | *Pyrus malus* | ..... |
| Algaroba pods | *Prosopis juliflora* | ..... |
| Chopped pods | *Prosopis juliflora* | ..... |
| Avocado pear | *Persea gratissima* | ..... |
| Banana | *Musa sapientum* | ..... |
| Bael fruits | *Aegle marmelos* | ..... |
| Bermuda grass | *Synodon dactylon* | ..... |
| Betelnut fruit | *Areca catechu* | ..... |
| Bread Fruit | *Articarpus incisa* | ..... |
| Broom Grass | *Anaropogon sorghum vulgaris* | ..... |
| Bush beans | *Phaseolus vulgaris* var. *nanus* | Isabella |
| Cacao | *Theobroma cacao* | ..... |
| Calabash fruit | *Crescentia cujete* | ..... |
| Calabash gourds | *Cucurbita maxima* | ..... |
| Carambola | *Averrhoa carambola* | ..... |
| Cashew | *Anacardium occidentale* | ..... |
| Cassava roots and stems | *Manihot utilissima* | ..... |
| Castor oil | *Racinus communis* | ..... |
| Cayenne Cherry | *Eugenia michelii* | ..... |
| Celery | *Apium graveolens* | ..... |
| Cocoanuts | *Cocos nucifera* | ..... |
| Coffee | *Coffee arabica* | ..... |
| Coffee | *Coffee arabica* | Pea berry |
| Chinese Orange | *Citrus trifoliata* | ..... |
| Chinese Plum | *Eugenia* sp. | ..... |
| Citron | *Citrus medica* var. *genuina* | ..... |
| Corn | *Zea mays* | Mammoth Sweet |

| Common Name | Scientific Name | Varietal Name (if any) |
|---|---|---|
| Cow Pea | *Vigna catjang* | ..... |
| Cow Pea | *Vigna catjang* var. *sinensis* | ..... |
| Dates | *Phoenix dactylifera* | ..... |
| Dates | *Phoenix dactylifera* | Haw. seedling |
| Egyptian cotton | *Gossypium* sp. | ..... |
| Seed of Egyptian cotton | *Gossypium* sp. | ..... |
| Grapes | *Vitus labrusca* | ..... |
| Grapes | *Vitus labrusca* | Isabella |
| Guava | *Psidium guayava* var. *pyriferum* | ..... |
| Guava jelley | ..... | ..... |
| Strawberry Guava | *Psidium cattleianum* | ..... |
| Guinea Grass | *Panicum altissimum* | ..... |
| Indian Corn | *Zea mays* | ..... |
| Jack Fruit | *Articarpus integrifolia* | ..... |
| Jerusalem Corn | *Andropogon sorghum vulgaris* | ..... |
| Kaffir Corn | *Andropogon sorghum vulgaris* | White |
| Kukui nuts | *Aleurites moluccana* | ..... |
| Kukui oil | ..... | ..... |
| Lauhala fruit | *Pandanus odoratissimus* | ..... |
| Lauhala seeds | *Pandanus odoratissimus* | ..... |
| Lemons | *Citrus medica* var. *limon* | |
| Limes | *Citrus medica* var. *acida* | ..... |
| Litchi | *Nephelium litchi* | ..... |
| Longan | *Nephelium longana* | ..... |
| Macadamia nuts | *Macadamia ternifolia* | ..... |
| Mammee Apple | *Mammea americana* | |
| Mandarin | *Citrus nobilis* | ..... |

| Common Name | Scientific Name | Varietal Name (if any) |
|---|---|---|
| Mango | *Mangifera indica* | Samoan |
| Mango | " " | Pineapple |
| Mango | " " | Vanilla |
| Mango | " " | Lady finger |
| Mango | " " | Herbert's No. 9. |
| Mango | " " | No. 9 |
| Mango | " " | Indian |
| Mango | " " | Turpentine |
| Mango | " " | Robin |
| Mango | " " | Mangostin |
| Mango | " " | Chinese |
| Mango | " " | Double Pointed Manila |
| Mango | " " | French |
| Mango | " " | Waianae Mission |
| Mango | " " | Hawaiian Sweet |
| Mango | " " | Kauai Chutney |
| Mango | " " | Strawberry |
| Milo maize | *Sorghum vulgaris* | ..... |
| Monstera | *Monstera deliciosa* | ..... |
| Mountain Apple | *Eugenia calacensis* | ..... |
| Ohelo | *Vaccinium reticulatum* | ..... |
| Oil Palm seeds | *Elaeis guineensis* | ..... |
| Orange | *Citrus aurantium* var. *sinensis* | Haw. seedling |
| Orange | *Citrus aurantium* var. *sinensis* | Navel |
| Otaheite Gooseberry | *Phyllanthus distichus* | ..... |
| Paddy or rough rice | *Oryza sativa* | ..... |
| Papaia | *Carica papaya* | Long |
| Papaia | *Carica papaya* | Large round |
| Para grass | *Panicum molle* | ..... |
| Paspalum | *Paspalum dilitatum* | ..... |
| Pear | *Pyrus sinensis* | ..... |
| Peppers | *Capsicum* sp. | ..... |
| Pineapple | *Ananas sativus* | ..... |

| Common Name | Scientific Name | Varietal Name (if any) |
|---|---|---|
| Poha or Cape Gooseberry | *Physalis peruviana* | ..... |
| Pomelo | *Citrus decumana* | ..... |
| Pomegranate | *Punica granatum* | ..... |
| Potatoes | *Solanum tuberosum* | |
| Prickly Pear | *Opuntia tuna* | ..... |
| Pulu from Tree Fern | *Cibotium chamissoi* | ..... |
| Pulu from Tree Fern | *Cibotium menziessi* | ..... |
| Rice heads | *Oryza sativa* | ..... |
| Polished rice | *Oryza sativa* | ..... |
| Hulled rice | *Oryza sativa* | ..... |
| Sapodilla | *Achras sapota* | ..... |
| Shaddock | *Citrus decumana* | ..... |
| Sorghum | *Andropogon sorghum* | Amber |
| Sour sop | | ..... |
| Starch made from Manioc | *Manihot utilissima* | ..... |
| Tamarind | *Tamarindus indica* | ..... |
| Taro | *Colocasia antiquorum* var. *essentum* | Dry Land |
| Velvet Bean | *Mercuna utilis* | ..... |
| Yard long beans | *Dolichos sesquipedalis* | ..... |
| Water Lemon | *Passiflora laurifolia* | ..... |
| Purple Water Lemon | *Passiflora edulis* | ..... |

## LIST OF DISTRICT FORESTERS.

The following is a list of the District Foresters, with their respective jurisdictions:

### DISTRICT FORESTERS.

#### ISLAND OF KAUAI.

Honorable Albert S. Wilcox, Forester, in and for that portion of the District of Hanalei extending from Waimea to and including the land of Kalihiwai.

Mr. Andrew Moore, Forester, in and for that portion of the Districts of Hanalei and Kawaihau extending from Kalihiwai to and including the land of Anahola.

Mr. George H. Fairchild, Forester, in and for that portion of the district of Kawaihau extending from Anahola to the District of Lihue.

Mr. F. Weber, Forester, in and for the District of Lihue.

Rev. J. M. Lydgate, Forester, in and for the District of Koloa.

Mr. Francis Gay, Forester, in and for the District of Waimea.

#### ISLAND OF OAHU.

Honorable D. Paul R. Isenberg, Forester, in and for that portion of the District of Honolulu extending from Makapuu Point, to and including Manoa Valley.

Mr. Walter F. Dillingham, Forester, in and for the Districts of Ewa and Waianae.

Mr. A. M. Nowell, Forester, in and for the District of Waialua.

Mr. Andrew Adams, Forester, in and for the District of Koolauloa.

Honorable L. L. McCandless, Forester, in and for that portion of the District of Kaalaupoko extending from Koolauloa to the land of Heeia.

Mr. C. Bolte, Forester, in and for that portion of the District of Koolaupoko extending from and including Heeia to the land of Kailua.

Mr. John Herd, Forester, in and for that portion of the District of Koolaupoko extending from and including the land of Kailua to Makapuu Point.

ISLAND OF MOLOKAI.

Mr. G. C. Munro, Forester, in and for the Island of Molokai.

ISLAND OF MAUI.

Mr. L. Barkhausen, Forester, in and for the District of Lahaina.

Honorable H. P. Baldwin, Forester, in and for the District of Kaanapali.

Mr. C. B. Wells, Forester, in and for the District of Wailuku.

Mr. H. A. Baldwin, Forester, in and for the Districts of Hamakualoa and Koolau.

Mr. L. von Tempsky, Forester, in and for the District of Makawao.

Mr. L. von Tempsky and Dr. J. H. Raymond, Foresters, in and for the Districts of Kula, Honuaula, and the lands beyond, to and including Kaupo.

ISLAND OF HAWAII.

Mr. E. E. Olding, Forester, in and for the District of North Kohala, and that portion of the District of Hamakua, lying between said District of North Kohala and Waimanu Valley.

Mr. F. W. Carter, Forester, in and for the District of South Kohala, and that portion of the District of Kohala and that portion of the District of Hamakua, lying mauka of the Hamakua forest reservation which is to be located along the northeasterly slopes of Mauna Kea.

Mr. George Ross, Forester, in and for that portion of the District of Hilo extending from the District of Hamakua, to and including the Honomu Plantation.

Mr. John Watt, Forester, in and for the District of Puna.

Mr. Julian Monsarrat, Forester, in and for that portion of the District of Kau extending from Puna to and including the land of Punaluu.

Mr. G. C. Hewitt, Forester, in and for that portion of the District of Kau extending from the land of Punaluu to the District of Kona.

Mr. Franz Buchholtz, Forester, in and for that portion of the District of South Kona extending from the District of Kau to the land of Kaohe.

Mr. Wm. R. Castle, Forester, in and for that portion of the District of South Kona extending from and including the land of Kaohe to the District of North Kona.

Honorable John D. Paris, Forester, in and for that portion of the District of North Kona extending from South Kona to and including the land of Kahaluu.

Mr. John Maguire, Forester, in and for that portion of the District of North Kona extending from Kahaluu to the District of South Kohala.

## REPORTS OF DISTRICT FORESTERS.

Early in December the Superintendent of Forestry sent to each of the District Foresters a copy of the following letter. The reports received in response thereto are given below:

HONOLULU, T. H., December 3, 1904.

Dear Sir:

The law creating the Board of Agriculture and Forestry makes it mandatory that a report be made and published at the the end of each year.

As a part of the Annual Report of the Division of Forestry I wish to include special reports from the various consulting foresters. To this end I should be very glad to have you furnish me, not later than December 20th, with a short statement from your district, which can be published.

I would suggest that information on the following points would be in order and acceptable:

*Planted Forest*—Approximate area in your district, object of plantations, age, kind and size of trees, with special refer-

ence to those which have been found to do well; recommendations as to future planting, cost, and returns from cuttings.

*Forest Nurseries*—Number, size and capacity of those in your district.

*Native Forest*—Present condition, with special reference to any insect or other injuries sustained during the past year; notes on the utilization of any forest products.

*Forestry in General*—Notes on any other forestry matters.

In my own report will be a statement of what has been done in each district toward the creation of forest reserves, with an outline of what is proposed and recommendations thereon.

Thanking you for your contribution to the report, I am,

Very truly yours,

RALPH S. HOSMER,
Superintendent of Forestry.

REPORT OF MR. ANDREW MOORE.

*Kawaihau—Kauai.*

KILAUEA, KAUAI, H. T., Dec. 9, 1904.

Your favor of the 3rd inst. was received, in which you request information in reference to the Forestry conditions of this district.

*Planted Forest*—On this plantation there are about 40 acres that were planted with Ironwood trees about 15 years ago, under Mr. MacFie. The object in planting this acreage, which is divided into several plots, was to utilize waste land with the growth of a class of trees that would in time be remunerative, through supplying fence posts and wood, for fuel. The trees have grown very well, and while they are planted too thick to enable large trees to be grown, they have grown tall, being from 60 to 80 feet high. Where planted away from other trees, a very large growth is obtained. On account of favorable climatic conditions the trees grow very straight, so that flag poles 60 feet long are common, and have been cut from the plantations.

Blue Gum trees also have a very thrifty growth, where planted along roadways.

Trees of these or similar varieties can be grown to advantage anywhere on this plantation, as there is sufficient rainfall to maintain them. It would be necessary to clear the land of grass for the planting and to take care of the young trees until started.

*Forest Nurseries*—There are none in this district, nor has any special attention been devoted to this subject.

*Native Forest*—Twenty years ago the majority of the land in this district was covered with a growth of trees. Much of this was cleared away to make way for cane. There was left, however, a field of about 150 acres of Kukui trees, in about the center of the plantation. These trees have a very fine growth, and present a beautiful appearance, showing that the natural conditions are well suited for the growth of forests.

The trees in the Kukui grove are thick enough to shade the ground, preventing the growth of Lantana and grass below the trees, and around the roots. Where the trees are scattered the growth is affected by the roots being covered with a growth of grass, or shrubs.

The original forest on the lands not used for cane was cut for fuel, some being shipped to Honolulu in early days, and some being used for the plantation, so that now there are but few trees until the foothills are reached, then the trees are small and scattered, being thickly intergrown with grass, principally Hilo Grass, and Lantana.

At the same time one can see scattered all over the land dead stumps of trees of a very large growth, indicating that at one time the land was covered with a very heavy forest, principally of native Ohia trees. These trees furnish first-class fuel, also railroad ties, as the wood has a close grain, and is hard. A few Koa trees remain, but of small growth.

On account of the land being covered with a very heavy growth of Hilo Grass it is impossible for seed to reach the ground to be propagated, so that for a forest to be started on the lands of this district it will be necessary to clear them, and plant such trees as are wanted. The mountain sides still have a growth of small trees, but these are intergrown with grasses and Lantana, so that the growth of the trees cannot long remain healthy.

The grasses are not suited for grazing, so that the land is

practically valueless under its present conditions. It could be rendered very valuable if reforested, and as the climatic conditions are exceptionally favorable there is no reason why forests of very valuable woods may not be produced.

Should your department wish to have any trials made, the plantation will willingly carry out such instructions as you may give us in reference to the same, and in time the forest reserves may be of value.

Very truly yours,

A. MOORE.

REPORT OF MR. GEORGE H. FAIRCHILD.

*Kawaihau—Kauai.*

KEALIA, KAUAI, Dec. 17, 1904.

Replying to your letter of the 3rd inst., I am sorry that I am unable to report as desired. There has been nothing done in this district and the Government has provided neither men nor means to accomplish anything in the way of preserving the existing forests or enlarging them.

Colonel Spaulding has planted trees in a small way about his grounds, outside of that nothing has been done by private parties in this district.

The forests are in the same condition here as elsewhere about the Islands, and rapidly deteriorating, owing to the presence of cattle and other well known causes.

A preliminary forest line has just been laid over the lands of Kealea, Anahola and Kamalomaloo, but unless a fence is constructed the boundary line will be of no value,, of course.

Trusting the foregoing report, while of no value, explains the reasons for there being no opportunity to submit a valuable report, I am,

Very truly yours,

G. H. FAIRCHILD.

REPORT OF MR. F. WEBER.

*Lihue—Kauai.*

LIHUE, KAUAI, Dec. 20, 1904.

Pursuant to your communication of the 3rd inst. I take pleasure in submitting the following data as to the forests of this district:

*Planted Forest*—The first steps to introduce foreign trees in this district were taken by Hon. G. N. Wilcox in 1872, when this gentleman planted near his residence a grove of Ironwood trees (*Casuarina*) from seed taken from the old Government grounds in Honolulu, where the present well known firm of H. Hackfeld & Company, Limited, is now located. These trees have attained a height of probably 100 feet, and their trunks measure about 2 feet in diameter. Since then Mr. Wilcox has planted additional land in trees until now Grove Farm has about 75 acres covered with trees of the following varieties: *Grevillea robusta* (Australian Silver Oak), Eucalyptus, Pride of India, Java Plum, *Poinciana regia* and *Casuarina*.

In 1882 Lihue Plantation Company commenced to reforest on a larger scale an area of 600 acres, at an elevation of from 250 feet to 500 feet, with Ironwood, Koa, Cassia and Eucalyptus (Blue Gum) for the purpose of getting a supply of firewood and to retain the rain-water. The nature of this land is very hilly and of poor quality, still, all these trees have done well, except the Ironwood trees above the 400 feet level, which elevation appears to be the limit for this variety in this district. The forest has well served its purpose, yielding yearly about 250 cords firewood from trimmings and from thinning out, and having developed a steady stream of almost a million gallons of water in 24 hours.

A good deal of tree planting in an experimental way has been done by Mr. H. Isenberg at his mountain house, Kukaua, elevation 1000 feet, and the following varieties found doing well there:

*Eucalyptus citriodora* (Lemon Gum)—Doing very well.
*Eucalyptus rostrata* (Red Gum)—Doing very well.
*Eucalyptus amygdalina*—Doing very well.
*Grevillea robusta*—Doing very well.

*Cryptomeria japonica*—(Japan Cedar)—Doing very well in higher elevations.

*Acacia melanoxylon* (Black Wood Tree)—Doing very well mauka and makai.

*Poinciana regia*—Doing well makai only.

*Laurus camphora* (Camphor tree)—Doing very well.

Those found not doing so well are *Acacia molissima* and *Acacia decurrens* (Black Wattle).

*Cryptomeria japonica* especially, is a very promising tree, producing valuable building material and being easily propagated from slips. From about six trees planted in 1901 there are now 500 growing, the largest being 15 feet high.

Lihue Plantation Company has also planted trees for a wind break, consisting of about 100,000 Ironwood trees, between their cane fields and the sea, and extending from Nawiliwili Bay to the Wailua Flats, or a distance of about four miles. These trees have to be irrigated occasionally, and are growing fast. Total area of trees planted is about 1000 acres.

*Forest Nurseries*—The young trees for these plantings have been started either at the gardens of Mr. Isenberg, Mr. Wilcox or the writer.

*Native Forest*—Our native forest has been fenced off since 1894 and stock kept out, and has since recuperated astonishingly well. Thousands of Ohia Lehuas have sprung up and attained a height of 20 feet.

For future planting I recommend all the varieties mentioned, to be planted in their respective favorite elevations.

At the beginning of the year I noticd a small catrpillar destroying the seeds of the Koa trees and also the buds on the young shoots.

Respectfully submitted,

F. WEBER,
Consulting Forester.

REPORT OF REV. J. M. LYDGATE.

*Koloa—Kauai.*

The forest region of the District of Koloa, Kauai, is almost wholly included within the estate of the McBryde Sugar Com-

pany. This company is intelligently awake to the vital importance of protecting their forest area. The more so that water is the essential factor of success with them, and flowing mountain water is vastly cheaper than pumped water. Accordingly they have taken steps to set aside and fence the mountain region as a forest reserve. They will construct a substantial fence some five miles in length from the Piwai ridge, back of Koloa, to the Hanapepe Valley, and will carefully remove all cattle from this reservation. It is expected that this work will be completed in a few months.

On the lower lands, on the sides of valleys and other waste lands, a beginning has been made in the way of forestry, mainly for fuel purposes, both by the Koloa Plantation Company and the McBryde Sugar Company. Mr. W. D. McBryde has also begun a very commendable personal work in the way of tree planting.

J. M. LYDGATE.

REPORT OF MR. FRANCIS GAY.

*Waimea—Kauai.*

MAKAWELI, Dec. 9th, 1904.

In reply to your letter of the 3rd inst. I beg to report:

*Planted Forest.*—Prior to 1880 there was no forest on the low lands of this district, but about that time the land-owners planted Algaroba trees in many places and there are now hundreds of acres of land covered with these trees, which are now a source of income to the owners, both as fuel and fodder.

*Forest Nurseries.*—There are no forest nurseries at the present time in the district, as the Algaroba is the only tree that has been found suitable for this locality and it does not require nurseries.

*Native Forest.*—The condition of the Native Forest is better than it was some years ago, owing to the efforts of the land-owners to rid the land of wild cattle and goats, and I find in many places that young trees are now growing.

I have noticed no damage to the forest from insects during

the last year, but have observed in many places that Lantana is choking out forest trees.

There has been no utilization in our district of the products of our Native Forest.

Yours truly,

FRANCIS GAY.

REPORT OF MR. W. F. DILLINGHAM.

*Ewa and Waianae—Oahu.*

HONOLULU, HAWAII, Dec. 29, 1904.

Referring to your letter of December 3rd, I would say:

*Planted Forest.*—Within the Ewa District I find that nothing has been done in regard to planting the forest, but I have learned from the manager of the Honolulu Plantation, Mr. James A. Low, that just so soon as the work is taken up and the mountain fences back of the Honolulu Plantation completed according to the plan as outlined in my original report to the Governor, the Honolulu Plantation is ready and anxious to start in the foresting of the hillsides in that locality.

*Forest Nurseries.*—Two years ago a forest nursery was established on the lower end of the Waianae Range. By referring to the forest map, which was submitted by me with my first report to the Governor, you will note an irregular jog at the southwestern corner of the Waianae Reservation. The jog represents some five hundred acres. H. M. von Holt, Superintendent of the Oahu Railway and Land Company ranches, has started a nursery at this place. The elevation is about 2,000 feet above sea level. Trees of various kinds, secured from the Government Nursery, have been set out and about five acres planted. Within this reservation of 500 acres he has set out some 2,000 trees of various imported varieties and about a thousand Kukui trees. Mr. von Holt reports that in addition to these trees, some 3,000 young Koa trees are springing up from old roots and dropped seeds. Two men are employed in caring for the trees. These men once or twice a week make a tour of the ridge with rifles to drive the goats away. The results of this work are most encouraging, as it is already noticeable that the springs,

of which there are quite a few in this locality, are increasing. In some cases where a few years ago there was simply a marshy or boggy spot, now there is a pool, and in one case a small stream is flowing. The Algaroba forest, which ten years ago was limited to the rocky land extending back from the sea coast a few thousand feet, now spreads over the foothills back two or three miles and to an elevation of 1800 feet. The starting of a forest at this section of the district is much more easily accomplished than on the Koolau Range and with a little assistance and a continuous effort to keep the goats from off these peaks, I believe that several thousand acres can be reforested in a comparatively short time.

*Native Forest.*—There is very little left of the native forest on the Waianae Range, but on the Koolau section of this district there are many hundred acres in comparatively rank growth. The forest fence which was constructed a number of years ago, extends from the boundary of Waianae Uka across Waipio, Waiawa, Manana, Waimano and Waiau. The cattle have been practically excluded from the section between this fence and the summit of the range and while the forest is slow in replanting itself on the ridges, due to the fact that the Hilo Grass is so closely matted as to make it practically impossible for the seeds to reach the soil, the valleys are once more in their natural tropical jungle state. I believe that it would not require a very great effort to secure assistance in extending this forest fence from Waiau across the lands of Waimalu, Kalauao, Aiea and the two lands of Halawa. As soon as this fence is completed we could look to the Honolulu Plantation to start in work on foresting the Kalauao, Aiea and Halawa lands.

I have recently made an experiment of planting out the seeds of the Australian Black Wattle and from the number of seeds which have sprouted, I believe that this tree will be one of the most satisfactory and economical to start on the barren ridges which divide the gulches in this section of the country. It seems necessary to set out some quick, hardy growing tree for a start as until some shelter is growing, it will be impossible to plant most of the jungle trees on these wind swept ridges. I would suggest that a good plan would be to set out rows of these trees along the proposed lower boundary of the forest reservation so that by the time the first fences were gone the trees could be

used as fence posts either as they stand or by cutting and making regular fence posts of same, in either case reducing the cost of maintaining fences very materially. If there is one of the varieties of the Eucalyptus trees which starts well from seed this would probably prove a valuable tree in starting forest reservations or nurseries.

I regret that the Ewa District cannot report greater progress in the forestry work, but trust that some concerted action in the coming year will be taken by the plantations towards reforesting these hills.

Yours truly,

W. F. DILLINGHAM.

REPORT OF MR. A. M. NOWELL.

*Waialua—Oahu.*

WAIALUA, OAHU, Dec. 20, 1904.

In compliance with your request to furnish you with a statement of the forestry work in the Waialua District for the year 1904, I would say that this statement will of necessity be brief as there has been little or nothing done as yet to establish a system of forestry here. This has undoubtedly been due to the fact that other districts have been much more in need of the application of the principles of forestry than has Waialua and so have naturally demanded the greater part of the attention of the Board. My remarks, therefore, will be confined to a short description of the natural characteristics of this district.

The territorial district of Waialua comprises in all about 77,000 acres and extends from Kaena Point on the west, east along the Waianae Range to a point north of the Leilehua Ranch, across the Waialua table-land to the Koolau Range including the settlement of Wahiawa, thence northwest along the Koolau Range to the sea at Waimea.

*Native Forest.*—Of these 77,000 acres approximately 23,000 acres are in forest, the remainder being pasture land, cane land, rice land and kuleanas. This 23,000 acres is all native forest and as far as injurious insects are concerned is not suffering

to any great extent. There is need, however, in some sections of systematic cutting and the product can be easily and I believe profitably disposed of as fuel. About 18,000 acres of this forest land is in the Koolau Range, the other 5,000 being in the Waianae Range; the first named being by far the more important of the two, as it contains the head waters of six distinct streams, while the Waianae Range on the other hand is productive of no streams flowing into the Waialua District.

*Rainfall.*—The rainfall in this district at about sea level in the past four years has varied to a considerable extent viz.: in 1901, 35 inches; 1902, 27 inches; 1903, 16 inches; 1904, up to the time of writing, 69 inches, or an average of about 37 inches per year. There has been considerably more rain than this on the higher lands.

In conclusion I would say that I hope and expect by the end of next year there will be something definite to report in regard to the forest reserves, nurseries and planted forests.

Yours very respectfully,

A. M. NOWELL.

REPORT OF MR. ANDREW ADAMS.

*Koolauloa—Oahu.*

Mr. Andrew Adams, District Forester for the Koolauloa District, desired that no formal report for him be published, but in correspondence he stated that "The Plantation is constantly planting Ironwood trees, which are thriving, but no systematic effort has been made toward forest planting, in fact the little planting that has been done could scarcely be dignified by the term 'forestation.' There are no forest nurseries, except several boxes on the premises of the head luna and my own where Ironwood trees are started from seeds.

"The native forest in the mountains is in good condition, and the Koa, of which there is a good belt between Malaekahana and Kaipapau valleys, is vigorous and thriving. The insect usually preying upon the Koa is not so much in evidence in this forest, it appears to me, as formerly, and there are many young Koas springing up; some of this is sizeable timber, but

I doubt if it could ever be lumbered without great destruction to the surrounding forest, and especially the undergrowth, because of the almost inaccessible ridges on which the Koa stands.

I regret that more has not been done in the district in a definite way, but I trust that I shall be able to report to you very soon an arrangement which will insure the shutting out of cattle from a considerable area of forest in this district."

REPORT OF MR. JOHN HERD.

*South Koolaupoko—Oahu.*

MAUNAWILI RANCH, WAIMANALO, Dec. 15, 1904.

In compliance with your request I herewith submit a statement of forest conditions for past year:

*Trees Planted Out.*

| | |
|---|---|
| *Casuarina equisetifolia* | 3875 |
| *Grevillea robusta* | 519 |
| *Acacia melanoxylon* | 18 |
| *Parkia africana* | 1008 |
| *Eucalyptus robusta* | 210 |
| Alligator Pears | 46 |
| Mangoes (Manila and Chutney) | 150 |
| Kona Orange seedlings | 90 |
| Papaya | 55 |
| Pride of India | 250 |
| | 6221 |

This makes a total of 14,910 trees planted out since our nursery was started here in October, 1902.

The chief object in planting these trees has been to provide wind breaks for coffee fields. At present time we have started fencing in about ten acres, where there are a few old native Koa. We intend filling up this lot with young Koa trees from nursery next spring.

In nursery at present time are seedling beds of *Grevillea robusta,* native Koa, *Casuarina torulosa,* Royal Palm, *Eucalyptus citriodora* and seedling oranges and lemons.

There are no nurseries in this district other than this one on the estate.

The native forest in this district, which at best is confined to ravines and gulches, is not making any increase, it being in many directions open to range cattle, which keeps down young growth. The rapid growth of Guava has also, in a number of places, killed out the Ohia in the ravines and elsewhere.

The Alligator Pear here are attacked by a borer which has killed out all of our best trees.

Respectfully submitted.

JOHN HERD.

REPORT OF MR. L. L. MCCANDLESS.

*North Koolaupoko—Oahu.*

HONOLULU, T. H., Dec. 19, 1904.

In reply to your communication of the 3rd inst., requesting of me as Consulting Forester a short statement as to forestry conditions in my district, I beg to say that in the district which you desire me to report on, viz: Koolaupoko, there are no planted forests and no forest nurseries. In reference to native forests, I would say that the same appear to be generally in a good condition, though a small area has been somewhat injured by fire during the past year.

There is no marketable timber, the Koa being scrubby and other trees small. The Ironwood has been planted by some of the residents of the district and I find that it thrives well. The Alligator Pear does well but this year a worm has attacked and killed a few of the trees. The Monkey-pod, self-planted, is springing up in many places and is doing well.

I would suggest, for the preservation of the Mountain Forest, that the same be fenced and some means provided prohibiting graziers from setting fire to pasture land which too frequently extends into the Mountain Forest.

Respectfully submitted,

L. L. McCANDLESS.

REPORT OF MR. BOLTE.

*Middle Koolaupoko—Oahu.*

The Ohia and Kukui forests, on top of the Nuuanu Pali Mountain and Mount Konahuanui, are very clearly visible from our side, but they do not belong to our side, they are portions of the Nuuanu Valley forests. Further than those there is no forest between Ahuimanu and Maunawili, in the District of Koolaupoko, Island of Oahu. The mountain ridge, dividing the leeward side and windward side of Oahu, drops not very far from perpendicularly on the Koolaupoko part of the windward side, thus there is not room for a forest on the mountain side.

Surrounding the water-springs, in crevices in the nearly perpendicular mountain side, grow, unfenced, on top of the mountain spurs, a number of fair sized slumps of trees, mostly Kukui. At Heeia there has been fenced off, since a number of years, one of the valleys, to protect the trees in it and for the purpose of raising a little forest. The trees in this valley grow well, but not any better than the clumps of Kukui trees, which have a strong natural protection in the many sharp edged rocks that cover the ground in which they grow. Thus, what trees there are, are well protected; they are all growing well and have strong undergrowth protecting the water-springs. There have been no forest products from these native trees.

Planted forest and forest nurseries there are none here, unless Guava be considered such. If Guava had been left undisturbed from the beginning, it might by this time have made a forest covering over all the land in Koolaupoko. Not that I am hankering after any Guava forest, very much to the contrary, I wish we had never seen any Guavas on the Hawaiian Islands. As it is now Guava bushes cover large areas, making the land nearly as unfit for any use as Lantana does. It is to be hoped that after not too long a time our busy Entomologists will be able to find time to give their attention to Guavas and that they may be successful in discovering an insect which will eat nothing but Guava blossoms. From Guavas there has been a little forest-product in the shape of firewood and charcoal.

I do not consider it necessary to have any particular Forest Reserve in our part of Koolaupoko. I think the clumps of

trees, as they are now, are just about right and enough reserve for the protection of the water-springs.

Silk Oak grows well here and would probably make a valuable forest tree, but before being able to plant a forest of Oak, the present sort of a forest, Guava, would first have to be gotten rid of. Besides that, most of the lands here are held by lessees, and forests are something for land-owners to plant.

C. BOLTE.

Heeia, Dec. 20, 1904.

REPORT OF HON. PAUL R. ISENBERG.

HONOLULU, T. H., Jan. 27, 1905.

In response to your communication to me of December, I have really no report to make of the Division of Forestry under my supervision. I would state though that it gives me great satisfaction to inform you that the Algaroba trees are climbing up the valleys and are in a great many instances thick forests. I notice also that this tree is growing at a much higher elevation than it used to, and I hope that in years to come a great many of the lands which are now poorly covered with trees will be dense forests.

I should very much like to go over our forest lands with you at some date to be arranged between us, so that we could get some idea of what recommendations to make to the different land holders. I for myself think that all forest lands should be fenced off, and am ready to look into this matter with you.

Yours very truly,

PAUL R. ISENBERG.

REPORT OF MR. G. C. MUNRO.

*Island of Molokai.*

MOLOKAI RANCH, Dec. 31, 1904.

There is no large area of planted forest on Molokai; plantations consisting of small groves have at times been planted.

The American Sugar Company have experimented to some

extent with planting useful and shade trees on semi-dry lands exposed to frequent high winds, and a few thousand trees have been planted yearly, the plants being raised in this nursery but, on account of the adverse conditions, quite a number of the trees die before they get sufficient hold to resist the dry season and the wind. More success has attended planting on the borders of the wetter region on the mountain.

There has also been some experimenting with little success in foreign forest trees suitable for the wet mountain. Seeds and cuttings were furnished through Mr. Jared G. Smith of the United States Experiment Station but so far none have shown to be suitable. There is great need of some self-spreading, quick growing, useful forest trees to mix with the Ohia which is the general forest here.

The tree giving the most satisfactory result so far is the Swamp Mahogany, *Eucalyptus robusta*. Plants are easily raised from seed and there is little loss in planting out; the trees grow quickly and resist the wind and drought; and the wood will likely prove useful for fence posts.

Grevillea, Ironwood, Black Wattle, Blue Gum and others of the Eucalyptus have also been grown, but Swamp Mahogany has given the best results.

Some Mangroves, also procured through Mr. Jared G. Smith, have been planted on the mud flats along the coast and are growing vigorously.

The Algaroba forest extends in a narrow belt about twenty miles long along the southern coast and is rapidly extending up the valleys and slopes and even on to the elevated plains.

The American Sugar Company have a forest reserve of from 8,000 to 10,000 acres, a great part of which is denuded or partially denuded forest land. It includes part and adjoins the rest of the remaining forest. Stock has been excluded from this area for several years and there has since been an astonishing growth of underbrush and young trees and it is evident that the partially denuded parts will in time be fully reafforested. About a third of the American Sugar Company's land so reserved could with advantage be kept as forest and stock excluded, but the remainder could be utilized for more useful purposes and planting continued on them at the same time.

The great need in the Molokai forest is an admixture of large useful trees with the present prevailing Ohia.

G. C. MUNRO.

REPORT OF HON. H. P. BALDWIN.

*Kaanapali—Maui.*

Mr. Baldwin preferred not to make a regular report, but in correspondence in regard to the proposed Koolau Forest Reserve, said:

"As you probably know, we have been at work now for some time on a line of fence to enclose the Forestry Reserve, as approved by yourself and Governor Carter.

"The makai boundary of the Forestry Reserve, from and including the Opana land, not far East from Haiku, through on the line as agreed upon, to and including a greater portion of the Nahiku land, will soon be finished, so that it will be practically impossible for animals to range mauka of this line, excepting in the region of Halehaku and Peahi, where the natives own land on the mountain side of the proposed line. We will, however, run a fence mauka of the land that the natives own, so as to prevent stock from getting into the Forestry Reserve in this locality. The fence through Opana, and a portion of Halehaku, was constructed a good many years ago. From there on, to and including Nahiku, the fence is new.

"We expect this winter to start trees for reforesting portions of the Forest Reserve that have been denuded of trees. The trees that we have so far planted, for forestry purposes, on land that we own on the East side of Haiku, are the Grevillea, Eucalyptus, Ironwood and Java Plum.

"We start our own trees in small nurseries on our plantations, and purchase them of the only nursery in this region, owned by James Lindsay, at Haiku."

REPORT OF MR. H. A. BALDWIN.

*Hamakualoa—Maui.*

PAIA, MAUI, Jan. 23, 1905.

The following is a report on what has been done in this district in the way of tree planting:

Winter 1897-1898.

| | | | |
|---|---|---|---|
| Near Piiholo | trees | 20,884 | |
| Haiku Mill | " | 9,363 | |
| Kailiili | " | 11,354 | |
| Haiku | " | 8,520 | |
| | | | 50,121 |

Winter 1898-1899.

| | | | |
|---|---|---|---|
| Haiku Mill | " | 10,826 | |
| Piiholo | " | 13,168 | |
| Kailiili | " | 20,000 | |
| | | | 43,994 |

Winter 1899-1900.

| | | | |
|---|---|---|---|
| Haiku | " | 3,280 | |
| | | | 3,280 |

Winter 1900-1901.

| | | | |
|---|---|---|---|
| Haiku | " | 9,654 | |
| Opana | " | 5,480 | |
| Piiholo | " | 2,959 | |
| | | | 18,093 |

Winter 1901-1902.

| | | | |
|---|---|---|---|
| Piiholo | " | 9,595 | |
| Haiku | " | 1,812 | |
| | | | 11,407 |

Winter 1904-1905.

| | | | |
|---|---|---|---|
| Haiku | " | 14,758 | |
| Kailiili | " | 4,556 | |
| | | | 19,314 |
| Total | | | 146,209 |

We plant about 15,000 more trees at Kailiili this year.

As a rule we intend to plant about 800 trees to the acre, but as some of the new planting is done among trees set out some years ago, the average number per acre is probably nearer 500 trees. More than half of these are Eucalypts, mainly Blue Gum. Of the rest, the Ironwood forms the greater part. This tree is doing very well, as are also the Golden and Black Wattles, especially the former. The Silver Wattle seems to be very short lived.

The *Acacia melanoxylon* or Black Wood is doing very well also. The Grevillea is a very proimsing tree, growing well at all altitudes so far tried. A few specimens of Turpentine are doing exceedingly well, and I think will prove a valuable addition to our forests.

The sugar plantation here has planted considerable quantities that do not appear in the above report, being on the eastern side of Maliko Gulch, and in Mr. von Tempsky's district.

Respectfully submitted,

H. A. BALDWIN,
Hamakualoa, Maui.

REPORT OF MR. L. VON TEMPSKY.

*Makawao and Kula—Maui.*

MAKAWAO, MAUI, Dec. 17, 1904.

*Forestry in the District of Makawao.*

I regret to say that very few of the residents of this district fully appreciate the destruction that is going on in the forests of this island; and still fewer are making any attempt to remedy the disastrous effects that are bound to follow, when the forests on the slopes of Haleakala are a thing of the past.

The Maui Agricultural Company, of which Mr. H. A. Baldwin is the manager; the Hawaiian Commercial and Sugar Company, with Mr. H. P. Baldwin at its head, and the Haleakala Ranch are about the only ones in this district that are doing any real work in the tree planting line.

The Maui Agricultural Company has in the last few years planted about two hundred acres of land in trees, principally *Eucalyptus globulus,* with a few *Grevillea robusta, Eucalyptus robusta* and Pride of India.

Their object in planting trees is to supply the camps with firewood; the oldest *Eucalyptus globulus* are about seven years old, and have attained a height of about forty feet. No wood has been cut yet, so no returns can be given.

The Hawaiian Commercial and Sugar Company has devoted itself to planting trees along its roads and water ditches; also

in clumps among the laborer's quarters. Their object in planting being to beautify the place, and make the lot of their laborers as pleasant in their homes as possible. They have planted in all, in the last two or three years, some 100,000 trees, all of which are doing well, and comprising the following species: Along the roads, *Grevillea robusta, Poinciana regia, Casuarina* and Java Plum; among the quarters, Papaia, Java Plum, Alligator Pears, etc.

The Haleakala Ranch has planted in avenues along its roads and in groves scattered through its paddocks. Object to beautify the place, and afford shelter for the stock.

The groves vary in size from five to eighteen acres, and the trees run about two hundred to the acre; the groves are planted at from 2000 feet elevation to 5500 feet. At the 2000 foot elevation the following species have been tried: *Eucalyptus globulus, E. robusta, E. rostrata, E. citriodora, E. leucoxylon, E. amygdalina, Grevillea robusta, Cupressus macrocarpa,* Pepper Tree, Linden, Ash, Birch, Maple, Black Locust and White Locust, Copper Beech and Tulip Tree. All of these trees would grow well at this elevation were it not for the "Olinda Beetle" (as it is known here), which has destroyed completely all except the *Eucalyptus globulus, E. robusta, Grevillea robusta,* Pepper Tree, *Cupressus macrocarpa* and Tulip Tree.

At the 5500 foot elevation the same species have been tried with the exception of the Tulip and Pepper Trees, and the addition of the Silver Poplar, *Sequoia gigantea,* White and Yellow Pines.

The oldest trees on this ranch, planted by the writer, are five years old: *Eucalyptus globulus, Grevillea robusta,* the former having reached the height of forty feet and the latter about thirty-five feet.

The seeds are planted first in boxes, and at the age of about two or three months are set out in their permanent homes, costing at that time about three cents per tree. None of these trees have been cut, therefore can give no figures on returns from cuttings.

There are no forest nurseries in the Makawao District outside of those of the Hawaiian Commercial and Sugar Company and the Haleakala Ranch.

The condition of the native forest, where it has been fenced up and protected from cattle, is very satisfactory. Land that a few years ago (before being fenced) one could ride through on horseback with ease, is now such a tangle of young trees and undergrowth that it is next to impossible to get through on foot, and were it not for some insect that destroys the young Koa, Ohia, Mamani, etc., I think the forest would soon resume its primeval aspect. An importation of some bird that would destroy this insect, in some of its numerous forms, would be of immense assistance to the native forest.

In connection with the future reforestation of this Island I may state than at an elevation of 4000 feet the *Eucalyptus globulus,* aged about thirty years, are reseeding themselves to such an extent (in spite of what the cattle do to prevent their growth) that in a short time the young trees will have to be thinned out in order to be able to ride through.

Any intelligent man can see from this what the future of the *Eucalyptus globulus* will be in forty or fifty years. The same is going on at Ulupalakua with the *Eucalyptus rostrata,* at an elevation of 2000 feet.

In Kula at from two to three thousand feet the common Wattle is performing the same work. This tree, however, is very short lived, owing to an insect that bores innumerable minute holes in the bark, which causes the tree to bleed to death. This insect is of comparatively recent advent, as I remember very fine old Wattles at Ulupalakua, that were said to be over thirty years of age. Ten to fifteen is now about their limit.

On the commons of Kula the Algaroba is spreading rapidly, growing up to the 2500 foot elevation; of course, however, not growing there so fast as it does further down.

This autumn I have noticed also there for the first time the growth of the beautiful native shrub "Ohai." I have been over these commons for the past twenty-five years, and this is the first time I have either seen or heard of it in this locality; in fact, the natives who were with me when I saw it first (one of them an old man) didn't even know its name and thought it was a haole tree.

L. Von TEMPSKY,

REPORT OF MR. L. BARKHAUSEN.

*Lahaina—Maui.*

LAHAINA, MAUI, Dec. 8, 1904.

In reply to yours of the 3rd inst., I beg to state that the only steps in regard to forest preservation in this District have been taken on the land of, and by the Pioneer Mill Company, Limited, by fencing off the watershed at approximately 2000 feet elevation. This has proved very effective, as is demonstrated by the fact that the land makai of the fence has been entirely denuded of forest by cattle, while the mauka side shows an abundant growth of native trees, ferns, etc.

I have not noticed any insects or blights doing noticeable damage to the forest.

So far nothing has been done here in the way of planting new areas with trees.

Yours very truly,

L. BARKHAUSEN.

REPORT OF MR. C. B. WELLS.

*Wailuku—Maui.*

Mr. Wells had no formal report to make, as nothing had been done in his district toward forestry during the past year.

In conversation with the Superintendent of Forestry Mr. Wells stated that the Wailuku Sugar Company were prepared to protect the forest in connection with their proposed irrigation projects and that he was awaiting a visit from the Superintendent of Forestry for recommendations as to what should be done.

REPORT OF MR. E. E. OLDING.

*North Kohala—Hawaii.*

KOHALA, HAWAII, Dec. 16, 1904.

I submit herewith the following report on Forestry for this District:

*Planted Forest.*—The area planted in the District of North Kohala approximates 200 acres. The plantations are in small plots, varying from one acre to fifty acres, and from one to twenty years old, the object being to produce fuel and protect the cane fields from the high winds which prevail here during the greater part of the year.

*Varieties Planted.*—The varieties planted are principally Ironwood, Lavender and Blue Gum and Black Wattle. All of these varieties grow rapidly and reach a height of from thirty to forty feet in twelve to fifteen years, with a diameter of six to twelve inches.

Many other varieties do well, especially the Algaroba or Mesquite, which grows on the lower lands near the sea coast. The nursery work, clearing land and terrace planting and the care of young trees during first three years, costs approximately one hundred dollars per acre.

Planted six feet apart, or say 1210 trees per acre, this will yield in from twelve to fifteen years fifty cords of fire wood. The value of this, uncut, would be about six dollars per cord, or three hundred dollars per acre.

*Forest Nurseries.*—The forest nurseries are small and have a capacity in all of about 10,000 seedlings.

*Native Forest.*—Where this is unprotected from cattle it is rapidly disappearing. The natural conditions under which the native forest is produced being destroyed leave the trees still growing in a weak condition, so that they quickly fall a prey to any insect pests attacking them, and the thick matting of grass which follows the destruction of the fern growth prevents the seeds from germinating and taking root, so that in a few years the forest will be totally destroyed.

Where the native forest is protected from cattle, reproduction is normal and it is otherwise in a healthy condition.

*Forestry in General.*—The Planting of Algaroba trees on the waste and rocky areas along the west coast of this District would in time prevent the great radiation from this barren waste and would tend to reduce the velocity of the trade winds on the northeast side blowing from the sea.

Much more could be done in this district which would be of service, both from an economical and artistic standpoint, by

planting the waste lands and steep sides of ravines with trees, where at present nothing of value grows.

The trees already planted along the road sides and in waste places now make Kohala one of the most picturesque districts in the Hawaiian Islands.

Respectfully submitted,

E. E. OLDING,

REPORT OF MR. F. W. CARTER.

*South Kohala—Hawaii.*

KAMUELA, HAWAII, Dec. 16, 1904.

As per your request of Dec. 3rd I beg to report as follows:

The Parker Ranch has planted out on Government land, under lease to them this year, 735 Eucalyptus and Silk Oak trees, besides furnishing to outside parties 1831 trees of different varieties, over 200 of these being planted in the Courthouse yard and School premises.

The Ranch has on the Puukapu land made a reserve of 320 acres, which is fenced to protect the water head of streams and springs. This is known as the Haloa reserve. In fencing this reserve it virtually shuts out the cattle from the forest on the southeast side of Haloa hill and above the Kukuihaele reserve. I estimate there are only ten head of stock in there at present and they are being worked out as fast as possible. In these reserves the fern growth and Ohia trees are coming finely.

There is also a reserve on the land of Waikoloa, which is in the dry belt, which contains 6500 trees. It is too early yet to report which varieties do the best there.

There is also a reserve of 640 acres on the land of Paauhau to protect the Waiakamakapo Spring. No planting done there, this land was run over by the fire of 1901 and has been fenced over two years; the young Koa are coming on nicely, grasses and o-i very thick, no fern growth.

There have been put out of the nursery so far 13,253 trees.

At present time there is in the nursery 14,000 young trees.

In Waimea, on the Government land, there have been 500 holes prepared and only awaiting a rain to set out the young trees.

I recommend that as soon as possible the forest on the Kohala side of Waimea be protected, as I explained to Mr. Hall some time ago on his visit here, and also to you upon your first visit here.

Respectfully submitted,

F. W. CARTER.

REPORT OF CARL WILLING, NURSERYMAN AT THE PARKER RANCH.

The following report from Mr. Carl Willing, the Nurseryman employed by the Parker Ranch, may well be inserted in the report for the Kohala District:

WAIMEA, HAWAII, Nov. 1, 1904.

To MR. E. E. CONANT,
RECEIVER PARKER RANCH.—

I hereby present to you my report of the Nursery from November 1, 1903, to October 31, 1904:

After arriving in Waimea October 20, 1903, I started work erecting platforms, making seed boxes and the 1st of November sowing out the first seeds.

On January 15th I planted the first trees in the ground outside of Puuopelu.

On February 11th I received from San Francisco via Honolulu the following fruit trees:

| | Trees. | | Trees. |
|---|---|---|---|
| Grapes | 48 | Plums | 60 |
| Almonds | 12 | Naval Oranges | 12 |
| Walnuts | 12 | Lemons | 12 |
| Cherry | 12 | Peaches | 12 |
| Apricots | 12 | Currants | 6 |
| Apples | 12 | | |

In all 228 trees.

I planted these trees in the following places:

| | Trees. | | Trees. |
|---|---|---|---|
| Mana | 32 | Manager Carter's place | 32 |
| Waikiki | 82 | Lot on Kohala Road | 28 |
| Puuopelu | 38 | Keamoku Sheep Station | 16 |

I planted in every place a mixed variety.

On March 21st I began planting within the Stone Wall, which I continued till the place was filled, planting in all 8500 trees, of which 2000 were lost..

Between the time of planting in the Stone Wall I made holes in the inside lot of Puuopelu and planted 443 trees there. On the outside the amount was 735, making a total of 1180. Of these I only lost 12 per cent, replanting 126 trees.

I planted in paddock next to Ranch stables 695 trees; in Ahuli 762 trees; at Keamoku Sheep Station 85 trees; at Waikii 200 trees, making a total plantèd out on Ranch property, 11,422 trees.

The following were given away:

| | Trees. |
|---|---|
| To Mr. Carl Widemann | 835 |
| To Mr. Sam Spencer | 787 |
| To Sheriff for Courthouse yard | 185 |
| To Mr. Brightwell for School yard | 24 |

Making a total of 1831 trees given away.

Total amount planted and given away, 13,253 trees.

At the present time there are 4000 trees in boxes, most of them ready to be set out, and 10,000 in seed boxes.

All trees that were set out had to be irrigated many times and kept clear from weeds.

Besides this outside work is the daily work. This consists of making new boxes, sifting soil, repairing old boxes, transplanting seedlings, watering and keeping clean from weeds, and on hot days giving them shade for a couple of hours.

Below I give you a list of seeds which I received during the year.

On account of this high elevation I lost thousands of seedlings that were not adapted to this climate. This loss can be avoided in future and I can set out double the number of trees and more, the coming year.

SEEDS RECEIVED DURING YEAR.

*Eucalyptus globulus.*
" *resinifera,* valuable for posts, does well.
" *citriodora,* valuable for posts, does not do well.

*Eucalyptus botryoides,* valuables for posts, does not do well.
" *corynocalyx,* valuable for timber, does not do well.
" *corymbosa,* valuable for timber, does not do well.
" *crebra,* seed was old, never sowed.
" *goniocalyx,* valuable for posts, does well.
" *hemiphloia,* valuable for posts, does well.
" *haemastoma,* valuable for posts, does well.
" *polyanthema,* valuable for posts, does well.
" *rostrata,* best wood for underground.
" *saligna,* valuable for posts, does well.
" *siderophloia,* valuable for posts, does well.
" *tereticornis,* valuable for posts, does well.
" *viminalis,* valuable for posts, does well.
" *amygdalina,* a very large tree.
" *robusta,* valuable for underground.

*Eucalyptus amygdalina* lately received from Mr. Hosmer is said to be the largest tree on earth; more like the California Redwood, and good for the same uses, for shingles, rails, planking for ships and bridges.

*Acacia dealbata* (Silver Wattle), doing well, valuable.
" *decurrens* (Black Wattle), doing well, valuable.
" *latifolia.*
" *lineata.*
" *mollissima.*
" *elata.*
" *longifolia.*
" *baileyana.*
" *oblonga.*
" *wichta.*
" *rutritra.*
" *tiscolor.*
" *suaveolens.*
" *lopantha.*
" *obtera.*
" *melanoxylon,* Black Wood tree, valuable and doing well, growing as fast as *Eucalyptus.*

*Catalpa speciosa,* valuable, does not do well.
*Pinus ponderosa.*
*Pinus tuberculata.*

*Cryptomeria japonica,* seed was old, did not sow.
*Syncarpia laurifolia,* doing well.
*Grevillea robusta,* doing well.
*Casuarina quadrivalvis,* doing well.
*Dalbergia sisso,* doing well, want shelter.
*Macadamia hillii,* valuable wood, nut tree.
*Ceratonia selliqua* (carob), pods, valuable for cattle, doing well. This tree should be more planted. The seeds I had were old, only a few grew.

Quite a number of other varieties were lost on account of cold weather.

List of seed I have lately received from Mr. Hosmer and am sowing out in boxes; will be reported later:

*Albizzia stipulata.*
*Casuarina glauca* (Ironwood).
*Bombax ceiba* (Silk Cotton tree).
*Dalbergia sisso.*
*Sesbania tomentosa* (Ohai).
*Parkia africana.*
*Tectonia grandis* (Teak).
*Pinus coulteri.*
" *attenuata.*
" *lambertiana.*
" *jeffreyii.*
" *insignis* (Monterey Pine).
*Pseudotsuga macrocarpa* (Big Cone Spruce).

Yours truly,

CARL WILLING.

REPORT OF DAVID FORBES.

*Hamakua—Hawaii.*

HAMAKUA, HAWAII, January 14, 1905.

It is with a feeling of regret I have to report but small progress made in this district toward the reclaiming of the denuded or fast deteriorating forest, during the year just closed. Neighboring districts have made great advances. Hilo, as well as Kohala, have had their reserves established, while but a small sec-

tion of Hamakua has come in for consideration, viz: that strip of land lying between the valleys of Waipio and Waimanu, the location of which makes it of but little value as a forest reserve to the agricultural interests throughout the District. As against this concession I infer from late press notes that a section of the most valuable and necessary timber belt is likely to be turned over to the tender mercy of a rancher, and get its destruction completed at no distant date. The land referred to is Kaohe, in Eastern Hamakua, part of which was ruined by fire a few years ago.

No doubt all of the sections which have come under the consideration of your Board and Government in the districts enumerated require all of the forest remaining in their neighborhood, but none more so than Hamakua from the west boundaries of Ookala to the eastern slopes of Kohala Mountains, at base of Pualala and Kaala peaks. The casual observer cannot fail to notice, on riding along the upper boundaries of homesteads and canefields, how narrow and scarcely furnished is the remnant of forest left on this belt, and a prophet does not require to leave his own country to here predict that there remains but a very few years, at present rate of destruction, between the completion of Waimea bare plains and the cane fields along our shores, bring one clear connection. Such conditions are much to be lamented, for undoubtedly the result to all valuable agricultural lands along the northern coast will be disastrous.

In tree planting but little is done. When I say little, I refer to the areas planted, compared with that which ought to be done. In this District Pacific Sugar Mill and Paauhau Sugar Company have been the pioneers in tree planting to any extent. On Paauhau Plantation, at an elevation of 1400 feet, there stands a planting of 50 acres in extent, composed chiefly of *Eucalyptus,* and planted some twelve to thirteen years ago. The trees have been planted with the object of making timber and rear into the air from 75 to over 100 feet, with clear stems, and can supply all of the fence posts or telephone poles necessary in that community for years to come.

Honokaa Sugar Company have more recently done considerable planting, partly in a solid body, but to a greater extent as hedge rows and on field borders. There a good example is

shown, of *Grevillea robusta,* grown in a belt as wind break, in which position it seems to meet the requirements, and produces timber wonderfully rapidly. Hamakua Mill Company and Kukaiau Plantation Company have also done tree planting, but on a smaller scale than any of the above.

A number of the homesteaders have planted trees, looking to the future benefits to be derived, and shown good judgment in their selection of varieties and management of distribution, although much the larger percentage have planted but few trees apart from coffee and fruit trees, which as forest does not here come under consideration.

Pacific Sugar Mill, for the past 18 or more years, has taken an active part in forest reservation and planting, perhaps one of the most interesting experiments and least known is that of Cinchona trees. A clearing of some 13 acres planted 4′ x 4′, but now thinned to 8′ x 8′ apart, composed chiefly of two varieites, the *C. ledgeriana* and *C. officinalis,* although numbers of the *C. succirubra* and Grey Barks are included. In Ceylon the barks of these varieties run from 10 to 16 per cent of Quinine; these trees, it can be seen, unlike our sugar cane are grown for the percentage of bitterness contained, and their value based accordingly. I may here add that this experiment was carried out seventeen years ago, when the prices of Quinine ran high, since which date other drugs have come on the market to, in a great measure, supplant its consumption, reduce its cost, and practically put Cinchona supply in the hands of South Americans, "Cascarillas," who draw their barks from the natural forests of Peru and adjoining countries, in sufficient quantities, and lower prices than would justify an attempt at its culture as a paying enterprise.

Here another enclosure of some 10 to 12 acres in extent is planted to exotic trees of great variety, comprising Eucalypts of many sorts, Casuarinas in variety, Acacia ditto, *Grevillea robusta, Cupressus macrocarpa, C. lawsonia, Cryptomeria japonica, Artocarpus integrifolia* (Jack Tree), *Camphoria officnalis,* Auracaria of sorts, etc. A smaller enclosure at 300 feet elevation has been planted ten years ago to Java Plums and Casuarinas; the Casuarinas to remain as standards when large enough, the plum trees to be cut out in order to give them sufficient height and space.

Each year a number of trees are planted along the roadsides, field boundaries or waste and rough patches, where agricultural implements cannot be successfully operated. Within the past two years several thousands of seedlings have been planted in forest clearings above the 2000 foot elevation. This undertaking, however, has so far been a failure, for so soon as the trees have got established, that pest known here as "Olinda Beetle" comes along and stays by his work until nothing is left but a leafless stem. His taste being cultivatd to a high degree for exotic plants, nothing seems to upset him from the common Guava to the Blue Gum leaves.

In the work of tree planting general utility should never be lost sight of, while the purpose for which the tree is intended is of first consideration. During the writer's experience of seventeen years in Hamakua climate the following trees for various purposes have given best results. On lower, dry and exposed lands the *Casuarina quadrivalvis* is good for shelter or wind belts, yielding to the wind and again returning to an upright position. This, with its deep rooting characteristic make it admirablly suited as a wind-resister. When closely grown this variety of Ironwood makes a quick growing and handsome timber tree, or when thinly grown makes an equally handsome and ornamental tree. Next in order for wind belts or shelter the *Grevillea robusta* gives greatest satisfaction, but best results are obtained from this variety when grown in belts not less than 50 feet in breadth. An important feature, not to be lost sight of, is that other crops will grow and thrive, within a few feet of either of the varieties above mentioned.

As all around timber trees, for rapid growth and general usefulness within a limited number of years, the *Eucalyptus citriodora, E. robusta, Grevillea robusta,* and *Casuarina quadrivalvis* are the four best varieties of all our exotic trees, which have up to this date had sufficient time to demonstrate their adaptibility to our climate and soil.

Just recently the writer had occasion to thin out a number of trees from a planting seventeen years of age and by measurement at 35 feet from the butt a number of them squared 12 inches, towering up 130 feet in the air; those trees are grown at an elevation of 700 to 800 feet. Such timber has considerable value on a plantation and is utilized for such purposes as plow-

beams, wagon poles, wheel-spokes, etc., in fact, anything where a long grained, hard and elastic timber is required and substituted with better results in some cases, for our imported Oak, Ash or Hickory. For wagon-wheel spokes the Ironwood of variety mentioned has much to recommend it, while if grown as a timber tree it has another and valuable recommendation, insomuch that it is self reproducing and furnishes a coppice stronger than any other of our exotic trees.

The *Artocarpus integrofolia* is here a rapid grower and if planted for timber and to give quicker returns will supply a wood not inferior to our native *Acacia koa* for furniture or ornamental work, it having a close grain of dark brown color, and capable of taking a high polish. This tree is best adapted to the lower elevations and may not be considered suitable for the upper forests, nevertheless, if forestry is pursued on economical lines as well as adding to the amenity of our landscapes, there seems no reason why the Jack Tree should not share a place with our much admired, and deservedly so, Kukui tree, in adorning the ravines and sheltered corners along our coast line. Jack seeds are larger, have strength and vitality, and if scattered at random will wrestle for existence and usually come out on top.

Although our experience has been limited with the Araucarias there seems to be a future as forest trees for some of the varieties in that family, *A. excelsa, A. bidwillii* and *A. cunninghamii* are all rapid growers, which, together with *Cryptomeria japonica* offer a selection of conifers whose growing qualities are tested in this district at several elevations, showing no reason why, if grown extensively, the pine necessary for building material should not at some distant date be produced at home. The Japanese Larch I feel assured is a tree well worth experimenting with; it has been acclimatized to the warm shores of the Mediterranean and is now, even in more northern Europe supplanting the Italian Larch, so subject to the disease of Larch Blister.

A most encouraging outlook is offered at the nurseries of the Parker Ranch, and, although these nurseries are not in Hamakua proper, I cannot refrain from drawing attention to the thousands of healthy seedling, in all stages and of numerous varieties, the writer saw some months ago. The work of rais-

ing these trees, planting out, caring for and protecting them, is all done in a workmanlike and systematic manner. The various clumps and belts will, in the future, afford shelter and protection to the stock and so prove a valuable ranch asset.

In this general summary of conditions appertaining to Forestry, I have not attempted to get into conditions of the native forest in this district, and of which you are already familiar, and know how vital it is to our agricultural pursuits that a reserve should be created along the upper side of cane lands, as well as your having the power to keep the subject in foreground until some action is taken.

One suggestion I should like to offer in connection with importation of tree seeds, your Board being in touch with other countries can do so to better advantage than the private individual, both in cost and I believe also in quality. Such seeds as *Auracaria excelsa, A. cunninghamii, A. bidwillii,* Japanese Larch and *Casuarina quadrivalvis* I should be willing to take a few pounds at any time if you should entertain the idea, of course paying cost of same.

Trusting that the efforts made by you in the past year may be successful in establishing that interest so essential for the betterment of our Island forests and that in the words of Walter Scott, your motto may ever be the old Laird's advice to his son, John: "Be ye aye sticking in a tree, Jock, it will grow when ye are sleeping."

I remain, gentlemen,

Yours faithfully,

D. FORBES.

MR. GEORGE ROSS.

*North Hilo—Hawaii.*

The temporary absence of Mr. Ross from the Territory explains there being no report from his district. Mr. Ross is one of the most active of the District Foresters, and has done much for Forestry in Hilo.

REPORT OF MR. JOHN WATT.

*Puna—Hawaii.*

OLAA, HAWAII, Dec. 20, 1904.

Yours of December 3rd re. Forestry to hand and noted. In answer I beg to report as follows:

*Planted Forest.*—There is no planted forest in this District and very little tree planting of any kind has been done.

A number of fruit and shade trees have been planted around the houses, which have been built up within the past few years.

A few rubber trees have been planted on the homestead lot belonging to Mr. A. G. Curtis at Eleven Miles, on the Volcano Road.

These trees look exceedingly healthy and have attained a height of twenty-five feet. They were planted about four years ago.

*Forest Nurseries.*—There is no forest nursery in this District.

*Native Forest.*—The native trees, Ohia, Kukui, and Koa thrive well in this District. There are no injurious insects or pests attacking them.

None of these forest products are used to any extent commercially; the Ohia is used principally for fence posts, railroad ties and firewood.

Ohia railroad ties rot very quickly and are being replaced by imported lumber.

The cost of transporting Koa lumber prohibits its being used commercially.

*Forests in General.*—A great area of forest has been cleared away to make room for agricultural pursuits, but the Government should use every effort to create forest preserves.

I am a comparative stranger in this District and therefore am not informed upon what has been done toward forest preserves.

J. WATT.

REPORT OF MR. J. MONSARRAT.

*East Kau—Hawaii.*

KAPAPALA, KAU, HAWAII, Jan. 20, 1905.

I acknowledge receipt of your favor of the 16th inst., and in reply beg to say that nothing has been done by the Government in the way of a forest reserve in my division. I have waited patiently for a representative of the Government to visit my division, but so far no one has turned up. Aside from a commission, appointing me Forester, for a part of this District, have heard nothing more from the Bureau.

The forest reserve of the Hawaiian Agricultural Company containing some 40,000 to 50,000 acres, has been placed in my hands, and at present have full charge of it, the Hawaiian Agricultural Company paying all expenses in the way of repairs, etc., which amounts to quite an item in the course of a year. This reserve, as you know, is the largest of its kind on the Islands, and well deserves a visit from a professional forester, one who will give advice and tell us lots we don't know about a forest. Advice from a practical forester would be gladly taken by the Hawaiian Agricultural Company.

In connection with this reservation would say that at the present time it is next to impossible to penetrate it, for any distance. Young trees are coming up and showing a remarkable growth. All young trees look strong and healthy, but something must be done to put a stop to Japanese and others cutting down the young trees. Is there any law by which you can punish them?

Yours very truly,

J. MONSARRAT.

REPORT OF MR. GEORGE C. HEWITT.

*West Kau—Hawaii.*

Mr. George C. Hewitt, the Consulting Forester for West Kau, was prevented by duties in connection with the United States Circuit Court from making a regular report. Mr. He-

witt says in correspondence: "As near as I can learn the forest of Kau remains about as ever and no changes have taken place to notice."

REPORT OF MR. FRANZ BUCHHOLTZ.

*South Kona—Hawaii.*

HONOLULU, T. H., Dec. 22, 1904.

Your letter of the 3rd inst. came to hand and in answer to the several questions therein have this to say:

There exists in my district only virgin forest and to the best of my knowledge no new forest has been planted so far by anybody.

Forest nurseries do not exist unless you should feel inclined to call my clearings by that name. I have, as a matter of fact, cleared one acre lots at the following elevations: 2300 feet, 3200 feet, 4000 and 5000 feet. They have been also fenced and the whole affair cost between $5000 to $5500, but I have planted trees only on the lower lot, because the assistance which I expected from the Government did not come and it became too expensive for me to continue the experiment. My intention was to plant on each lot the same varieties of trees, in order to find out which ones would grow the best at the different elevations and on the different soils. I have planted the following varieties: Lebanon Cedar, Silk Oak, some Japanese Fir trees, with Oak, Camphor, Eucalyptus, Chinese Plum, African Locust, Ironwood and a number of fruit trees. The forest trees all do very well at an elevation of 2300 and at 1650 feet elecation, and I am of the opinion that some of them, particularly the Fir trees, would do better at the higher elevations.

The native forest is all in a vigorous condition, the dead or dying trees which one sees die because of old age, or as on the higher lands because there is not enough soil to permit them of growing any longer. Of insects which might have caused the death of trees, I have not noticed any this year, although there is no doubt in my mind that there exist some.

The forests of Hawaii are of the greatest importance to the welfare of the country and their proper management will benefit

the finances of this country enormously. I consider it a great mistake and a great waste the way the forests are attended to at present. The valuable woods which grow here, if properly handled, would give us an income of millions. Instead of creating forest reserves in which the trees are permitted to grow, die and rot, I should propose to cut the trees old enough for that purpose, sell them and plant new forests, which could be made as valuable and more so than the ones we have now, and give this country a continuous and large income for all time to come. I am also of the opinion that not *an acre of land* should be set aside for a forest reserve which could grow agricultural products, and only such lands planted and kept in forest of *which there are plenty,* which will grow nothing but forest.

FRANZ BUCHHOLTZ.

REPORT OF HON. J. D. PARIS.

*Central Kona—Hawaii.*

KEALAKEKUA, HAWAII, Jan. 16, 1905.

The condition of the forest in my section is as follows:

That section extending from Holualoa, North Kona, to Honalo, North Kona, a width of about four miles; there is a heavy forest principally of Koa and Ohia in good condition.

That portion extending from Honalo, North Kona, to Kahauloa in South Kona; the Koa and all the smaller trees, such as Pua, Kolea, Pilo and Opeko are fast disappearing, owing to the lands being stocked with cattle, the underbrush is cleared away, the old die out and the young trees are destroyed.

That section extending from Kahauloa to Honokua in South Kona; the forest is in fine condition. A portion of this includes the forest reserve fenced off by the Bishop Estate. The young Koa and other Hawaiian trees are growing up. This section is about six miles wide.

There has been no planting of foreign trees for forestry in the Konas. Although Blue Gum, Ironwood and some other foreign trees planted for ornamental purposes do well.

The forest has not suffered in my section from any blight, except on the Koa there is a worm which has been here for a

number of years and destroys the foliage. It is worse some years than others.

As a whole the forest in my section is in a healthy and thriving condition.

I remain,

J. D. PARIS.

REPORT OF MR. JOHN MAGUIRE.

*North Kona—Hawaii.*

HUEHUE, KAILUA, HAWAII, Dec. 14, 1904.

Owing to the porous nature of the soil of Kona there are no streams or springs, consequently Kona needs a great deal of forest vegetation to supply moisture to the country.

There is already a virgin forest around the base of Hualalai, which I think the Government should make every possible effort to preserve.

The forests of Kona consist of groves of beautiful Kukui, Koa and Ohia trees, all in their natural wildness, the Ieie forming a network in places impassable, even to cattle.

There are no planted forests in the district, a number of fruit trees, such as Mangoes, Alligator Pears and Oranges are often found growing wild along the roadside.

No foreign trees are planted for shade along the roads, the beautiful Kukui tree being found in abundance, an easy and natural shade tree. The Silk Oak (*Grevillea robusta*) does well in the open barren sections.

Even the Lantana is of use in covering the barren stretches of lava flows, and helps the supply of moisture to the country.

But to the ranchman it is a pest, as it covers up all the good pickings amongst the rocks. In April or May, 1903, some Lantana Blight was sent to me from the Agricultural Experiment Station of Honolulu. About a year after, I noticed brown spots among the Lantana, and within the past three months about 150 acres, more or less, of Lantana look apparently dead. I find the blight spreading rapidly, and at the rate it is working, the Lantana ought to be cleaned out around here in two or three years.

I notice the Mamani is springing up all over the slope of Hualalai, great stretches of barren country a few years ago are now solid forests almost impassable. The cattle do not seem to affect them. I hear it is the same on Mauna Kea and other places.

My theory is, that there must have been some insect that destroyed the old trees, and not the sheep and cattle, as these young forests of Mamani are not affected by the cattle that are now grazing in them. I have been told that years ago, during the reign of Kamehameha I. a fire swept the whole summit of Hualalai.

I have been asked twice to sell Koa bark for tanning, also Koa lumber. I do not believe in denuding forests; besides our forests are not extensive enough for any utilization of its products. The Koa seems to be naturally dying. Insects are rapidly destroying it as well as cattle, although I notice on knolls or places where cattle cannot get to, the trees are covered with insects and moss just the same.

Although I am a ranchman, I approve of forest preservation. My experience proves that it is absolutely necessary to have shade and moisture for cattle. All the Kona ranchmen know this and they reserve forest paddocks, which they use only during very dry weather, turning cattle out into makai lands whenever the rainy season begins.

The summit of Hualalai contains a number of extinct craters, and I doubt if they will ever be covered with vegetation, although the Mamani seems to be growing higher.

I advocate the preservation of forests along a line that will benefit the country below. In Kona the forest must be right in the line of settlement, and not on the tops of mountains as in other districts, for there is no watershed here. We must have moisture for water, and naturally we must have the forest as near to us as possible. Between 2,500 and 4,500 feet elevation is where the dense forest now is, and it will be an easy matter to preserve, although I think it will be hard to obtain the consent of private owners of land along that line, as in some parts of that location the best pasture lands lie, but Government lands which are there can easily be reserved.

J. A. MAGUIRE.

No reports were received from the other District Foresters.

# ENTOMOLOGY.

## REPORT OF R. C. L. PERKINS, ASSISTANT SUPERINTENDENT OF ENTOMOLOGY.

HONOLULU, OAHU, T. H., January 24, 1905.

TO THE HON. COMMISSIONERS OF THE
BOARD OF AGRICULTURE AND FORESTRY,
Honolulu, T. H.

GENTLEMEN:—Having myself just recently returned from a mission to Australia in company with Mr. Koebele, who still remains there, I am in his absence preparing a short account of the work carried out by him during the latter half of the year 1903 and the first few months of 1904, which time he chiefly spent in the States of Ohio and California. In May, 1903, Mr. Koebele, then Superintendent of Entomology under the Board, having completed his work on the insects attacking lantana in Mexico, and other matters, returned to Honolulu, but was granted leave of absence for two months by your honorable Board in order that he might more fully recover from the effects of the fever that he had contracted while working in the above-mentioned country.

On the expiration of this leave of absence, he had intended starting for Australia in search of natural enemies against the leaf-hopper of the sugar cane, and on July 14th, wrote to me to have all in readiness for him to go straight through to Sydney. About this time, however, he received information from the Department at Washington as to certain parasites of leaf-hoppers, which had been bred in Ohio by Mr. Otto Swezey and it was thought advisable to carry out some investigations in that locality.

Accordingly, Mr. Koebele proceeded to Columbus, Ohio, and continued his investigations in that State until October 10th, when the cold weather put an end to further entomological

work. During his stay in Ohio, work was entirely confined to the leaf-hopper question and about a dozen species of parasites on these (many of them quite new to science) were investigated, as well as certain predaceous insects likely to attack the cane pest of these islands. The living insects collected by Mr. Koebele were shipped at frequent intervals and handled at first by myself alone at the Government Nursery, but later on with the assistance of Messrs. Kirkaldy and Terry. Most of these consignments consisted of the cocoons of various species of ant-like parasites, resembling and allied to the Fairchild's parasite of the cane leaf-hopper, so well known to many sugar-growers. At the time when Mr. Koebele completed his work, I doubt whether more than a score or two of these insects had been bred in the United States, but to these islands I estimate the number of cocoons sent by him as not less than 3,000. From these, however, comparatively few mature insects were reared, because: (1) many were unable to stand the journey and died from some cause or other before arrival; and (2) many instead of producing the parasite, produced hyperparasites, which had destroyed the former.

In addition to these consignments of cocoons of parasites, which were despatched every two or three weeks, cages with living hoppers attacked by parasites were also sent.

On leaving Ohio, Mr. Koebele again visited and conferred with the entomologists at Washington, and returned to California to continue his researches on leaf-hopper parasites. From this State he continued to send consignments of cocoons and cages with living parasites, bringing the last lot with him on the "Sierra" of May 11th, when I joined him en route for Australia.

During the latter part of his stay in Alameda, in addition to leaf-hopper parasites, a few other beneficial insects (such as ladybirds for certain scale bugs) were also sent.

Of the twelve or more species of leaf-hopper parasites sent by Mr. Koebele, about four were bred in such numbers as to make their establishment here possible. One of these with winged female was bred in large numbers and distributed in various parts of Oahu and on Hawaii, in localities where the green Siphanta, sometimes called "torpedo-bug," was common. Whether this parasite has become established is not yet known.

The other three species of parasites all have wingless females, and were all experimented with as probable enemies of cane leaf-hopper. In confinement all three of these attacked the young leaf-hoppers, but the two species that were sent from Ohio did so less readily than the one from California. This was, I have no doubt, due to the fact that the California parasite was much more suited to this climate than those from Ohio, for while the former lived six weeks on an average in the breeding cages at the Government Nursery, the latter rarely survived a week's captivity. As a large number of the Californian parasite were liberated in the cane-fields and when liberated were seen to at once attack the young hoppers, it is reasonable to hope that this species at least will become firmly established.

It should be borne in mind that cases of rapid increase such as were exhibited by some of the lantana destroying insects, the Vedalia and Cryptolaemus ladybirds and others, are not normal, and, as I have elsewhere pointed out, it is usually two or three years before an imported insect becomes noticeably common.

Possibly, however, the greatest value of the work done by Mr. Koebele in Ohio and California lay in the mass of general information gained as to the various parasitic enemies of leaf-hoppers (a field, as I have shown above, very little investigated previously), and in the best mode of handling these parasites. Such information was of the greatest assistance when entering on the investigation of leaf-hopper enemies on the recent mission to Australia.

Finally, I am sure that Mr. Koebele would wish to express his obligations to all those who in any way assisted him in his researches, and especially to Dr. L. O. Howard and the entomologists of the Division of Entomology at Washington, to Prof. Herbert Osborn of the Ohio State University, and to Mr. Otto H. Swezey, who had previously investigated some of these parasites in Ohio. Also, as on previous occasions, we were specially indebted to Mr. Alexander Craw (now Superintendent of Entomology under your honorable Board) for taking proper charge of the insects, when they reached San Francisco and shipping them on to the islands.

Respectfully submitted,

R. C. L. PERKINS,

(Lately Assistant Superintendent of Entomology.)

# REPORT OF G. W. KIRKALDY, ACTING SUPERINTENDENT OF ENTOMOLOGY.

Honolulu, T. H., Aug. 12th, 1904.

The Honorable Board of Commissioners
of Agriculture and Forestry,
Honolulu, T. H.

Sirs:—In the absence of Professors Koebele and Perkins, I herewith beg to present my report as Acting Superintendent of the Division of Entomology, for the term between May 18th, 1903, and August 12th, 1904.

Respectfully submitted,

G. W. KIRKALDY,
Acting Superintendent.

The reorganization of the Entomological Division was decided upon at the first meeting of the Board of Commissioners of Agriculture and Forestry on May 18th, 1903, and on the same date Mr. R. C. L. Perkins was appointed assistant to Prof. Koebele. Messrs. G. W. Kirkaldy and F. W. Terry were later engaged as assistants, the former entering upon his duties August 14th, the latter September 2nd.

Though for some time the Entomologists were most inadequately housed in the basement of the Capitol Building, this was remedied by their removal during February to the new quarters on King Street, at the Government Nursery. These are well equipped as regards laboratory apparatus, but a good working library is necessary, and till this is supplied, the work must be incomplete. The prime cost should be not less than $1500.00 with a yearly subscription of $200.00 for periodicals and recent literature.

On May 11th, Prof. Koebele returned from America and, with Prof. Perkins, sailed to Australia in quest of beneficial insects, particularly parasites of the leaf-hopper.

In August the Division was again reorganized, the Hawaiian Sugar Planters' Association forming a separate division for the entomological study of sugar cane and taking over in its entirety the Entomological Division of the Bureau, viz.: Professors Koebele, Perkins, Kirkaldy and Terry. During the absence of Professors Koebele and Perkins, I acted as Superintendent and therefore present the following brief report in that capacity, this report ending on August 12th, the date of Mr. Craw's arrival from San Francisco.

The most important duties of the staff related to inspection work, and particular attention was devoted to this. From August 26, 1903, to August 12th, 1904, 201 visits were paid to incoming vessels by one or more of the Entomologists; a considerable number of visits also was made to the Post-office. Especial attention was devoted to plants, as may be seen from detailed statements further on.

While housed at the Capitol, considerable time was taken up by travelling to and from the Nursery and by the attention given there to the parasites; this, with Inspection, care of the Library and office routine work, fully occupied the time of the Entomologists. At the Government Nursery, the saving of time in travelling was more than balanced by increased correspondence and inspection. In April I sustained a badly broken leg which has had to be reset twice and is not completely healed even at date of writing.

The fumigation work was attended to by Mr. C. J. Austin, who also assisted the Inspector at the wharves.

A considerable amount of time was also taken up by visitors applying for information about insect pests, particularly those attacking fruit trees and garden plants; this constituted a large part of the routine work of the office, and will in time take up almost the whole of one man's time.

After Inspection, the principal work lay in the details of attention to the insects of the sugar cane and lantana. The work on the former cannot at present be detailed satisfactorily and will in any case be carried on by the Hawaiian Sugar Planters' Association. Mr. Perkins' Bulletin on the subject ("The Leaf-Hopper of the Sugar Cane," Bull. 1, Div. Ent., Brd. Com. Agr. For., T. H., 1903, by R. C. L. Perkins) may be con-

sulted with profit. Work on the Lantana is discussed further on.

## INSPECTION WORK.

### *(A) Plants and Roots.*

CALIFORNIA—1327 consignments of plants and roots were introduced from the Coast of which 136 were passed at once, and 1180 were removed to the Government Nursery for fumigation, of which one large consignment consisted of 500 Banana suckers from Central America.

A case of Mangrove roots which were very badly infested with at least three distinct borers were destroyed; of these borers two have since been bred up, one a weevil, one a Bostrychid; neither of which has been identified with material in the Bureau Museum; the third (a Lepidopterous larva?) died.

One box of plants via the Nevadan in January was badly infested with Scales, Mealy bugs, *Gryllus sp., Tortrix sp.,* all new to this Territory; in February, the Sonoma brought one case containing 125 fruit trees which were very badly infested with (among other things) a very large nest of a species of the ant *Prenolepis, Myrmecophila* (a curious ant—loving Cricket), two species (Imago and larvae) of Carabidae (predaceous ground beetles), Tenebrionids, Acari (very abundant), Thysanura and Centipedes.

In March the Sierra brought a case of violets which contained one Lepidopterous pupa, an Aphid, several Coleoptera, Thysanura, Psocidae and Acari.

WASHINGTON—Seattle. Three cases of plants all passed.

CANADA—Vancouver. Three cases of plants all passed.

CUBA (via California)—A hundred cases of pineapple plants, which were infested slighly by a Mealy bug (*Trechocorys bromeliae*), and were fumigated.

ENGLAND (via Australia)—One case of bulbs passed.

JAPAN—Fourteen cases of plants, etc., of which two harbored borers and were destroyed.

CHINA—Ten cases of plants of which nine were fumigated; also five cases of sugar cane which were destroyed. As regards

the latter, Mr. Perkins wrote specially to the Board, under date of Feb. 11th, as follows:

"I beg to notify you that today I am destroying five large cases of sugar cane imported for eating purposes, the consignee being Foo Fang. This cane is infested with borer, not Hawaiian, also "leaf-hopper", one or more species, also in all probability not Hawaiian, since the cane was grown in China (not Australia whence came our leaf-hopper). Owing to the serious nature of the case, it will be necessary to keep the unpacking room in the new building, where these cases were opened, locked up for some days as an extra precaution. If the importation of this cane had not clearly been made in ignorance, it would be a positive outrage under the circumstances."

AUSTRALIA—Sydney. Four cases of plants of which three were fumigated, also a consignment of pineapple plants (badly attacked by a fungus, *Monilia sp.?*) which were burnt.

NEW ZEALAND—One case of plants passed.

SAMOA—Pago Pago. Seven consignments of vanilla cuttings and three consignments of cacao pods, passed.

VITI (or FIJI) ISLANDS—Forty bundles of vanilla cuttings passed.

GUAM—Three cycads and one fern passed, the former after being fumigated.

PHILIPPINE ISLANDS—Manila. Two orchids passed.

### *(B) Fruits, Vegetables, Etc.*

CALIFORNIA—Forty-nine vessels brought general consignments of oranges, peaches, apples, cabbages, etc.*

Till comparatively recently, fruit and vegetables from the Coast were remarkably clean and free from pests. During the last two months, however, there has been a marked deterioration, in certain kinds. In June two very bad consignments of cabbages were brought by the "Alameda", the outer leaves being thickly infested with a cosmopolitan plant louse (*Aphis brassicae*). These were sent to the Government Nursery and the

* The total number of boxes of fruit thus imported was not computed by the Entomological Division.

outer leaves removed and burnt. Most of the cabbages were sold in this denuded condition, but some of the merchants declined to take delivery under these circumstances and apparently wrote to the Coast that the cabbages had been condemned altogether, as an angry letter was soon after received from a San Franciscan exporter.

On July 1st the same ship brought in three cases of limes from Acapulco, Mexico, and later on two more cases were brought; as this is the fountain of the Mexican fruit fly ravages, they were promptly burnt. Between that date and the present, 395 cases of peaches and apricots were refused admittance, being attacked by *Anarsia lineatella* (a Lepidopterous borer), which has not been recorded as occurring in the Territory, and is in any case a most undesirable reinforcement. Of these 395 cases, eight were consumed on board and 87 were destroyed at the Government burning grounds, while about 300 were reshipped to California.

A large proportion of apples was attacked by the Codling moth (*Carpocapsa pomonella*) and was destroyed; this moth, however, does not in any case appear to have been able to establish itself, probably owing to the unfavorable climate.

WASHINGTON—Seattle. Four consignments of fruits passed. Some of these consisted of apples which in a few cases were very slightly infested with the San Jose Scale (*Aspidiotus perniciosus*), but as this scale is quite innoxious here, no further steps were taken.

CHINA—Seven consignments of fruits from which ninety-three cases of pumelos and oranges were destroyed, being rotten and scaly; the rottenness was almost entirely due to gross carelessness or ignorance in packing. There were also numerous consignments of yams, ginger, and water-chestnuts.

JAPAN—Five consignments of oranges were passed.

AUSTRALIA—Sydney. One consignment of vegetables passed, also a consignment of pineapples and one of alligator pears, which were destroyed, being rotten. The pineapples were also attacked by a Mealy bug.

VITI ISLES—One case of yams passed.

FANNING ISLANDS—Six sacks of cocoanuts (*Cocos*) passed after being husked.

SAMOA—Three consignments of cocoanuts passed after being husked.

Besides these, the soils, etc., brought in by sundry vessels have been examined.

### REGULATIONS FOR INSPECTION, ETC.

The Board has since passed a number of regulations for the prevention of importation of new insect pests. These I considered necessary for the reasons set forth in the following letters:

HONOLULU, T. H., June 1, 1904.

TO THE HONORABLE BOARD OF COMMISSIONERS
OF AGRICULTURE AND FORESTRY,
Honolulu, T. H.

GENTLEMEN:—I beg to recommend to the Honorable Board the advisability of prohibiting the importation, into this Territory, of any fruits from China, Japan, and indeed from any Eastern Pacific ports.

This is in view of the danger of introducing fruit flies.

My reasons are as follows:

1. The American and Canadian Inspectors are so firmly impressed with a sense of the danger that would result from the appearance in these countries of any fruit-flies, that special attention is paid to the latter and we would be at once advised of such appearance in the Daily and Weekly press, and could thus take steps to guard against the pest in the event of its establishment on the mainland.

2. There are, however, no agricultural Journals, to my knowledge, in China, Japan, etc. (except the Bulletin of the Agricultural College, in the University of Tokyo, which would scarcely deal sufficiently promptly with the matter) so that on the inevitable appearance in the near future, of any of the flies in those countries, we would be likely to have them established within Hawaii before hearing of their arrival in China or Japan.

It is true that the imports of fruits from these countries are small except at one season of the year, but last January-March

I had such considerable trouble with citrus fruits brought in for the Chinese seasonal festivities, that in my opinion these imports were of distinct menace to the fruit cultivation of Hawaii, inasmuch as a large proportion of the fruit was so rotten, owing to bad packing, that it was impossible to say whether they harbored fruit-fly maggots or not. A proportion of the remainder was infested by scales, which it is true are found here, but it is not desirable to reinforce them from outside.

As you are aware, I ordered the destruction by fire of a large proportion of the fruits, but, bearing in mind the danger incurred by the necessary two or three days' exposure on the wharves, it is inadvisable to risk a repetition of the past months' experience.

The adoption by your Honorable Board of this recommendation would entail the exclusion of all fruits, except from the United States and Canada, and apart from its advisability for the above reasons, might possibly lead to increased activity in the cultivation of the many admirable Citrus fruits now established here.

Yours respectfully,

G. W. KIRKALDY,
Acting Superintendent.

HONOLULU, T. H., July 1st, 1904.

W. M. GIFFARD, ESQ.,
CHAIRMAN, COMMITTEE OF ENTOMOLOGY,
BOARD OF AGRICULTURE AND FORESTRY,
HONOLULU, T. H.—

Dear Sir: I beg to refer the Honorable Board to my letter of June 1st and to urge upon them the importance of this matter, which admits of no delay in settlement.

In writing that letter I laid special stress upon the danger of unknowingly importing fruit-flies from the Orient, Australia, etc., and considered that there was little fear of these arriving via Canada or the United States. (I did not mention Mexico or South America, as I believe no vessels come into port direct from these countries.)

Since then, however, the matter has assumed a fresh aspect, consequent upon the fact that three boxes of limes have escaped the vigilance of the Californian Inspectors and arrived here by the "Alameda" to-day. These limes were imported from Mexico and are labeled "choice Acapulco," this place being the headquarters in Mexico of the dreaded "Mexican Orange fruit-fly" (*Trypeta ludens*).

Under these circumstances I would respectfully urge that a regulation be framed *immediately* forbidding the introduction into *any* Hawaiian ports, of fruits from *any* countries except the United States and Canada, and further, confirming the authority of the Entomologists to destroy *instantly* any fruits, even from these latter countries, that they regard as suspicious.

I would again urge upon the Honorable Board the *paramount* and immediate importance of this matter.

Very respectfully,

G. W. KIRKALDY,
Acting Superintendent.

INSECTS OF THE YEAR.

It is obvious that a residence of one year in these Islands is insufficient for either of the Assistant Entomologists to speak with any degree of authority upon questions into which climatic or other local conditions enter; consequently this first report is merely preliminary, many important investigations as yet incomplete being held over. Furthermore, the absence of a properly equipped library has hampered the work of the Entomologists and has prevented any systematic attempt at the determination of the collections except in a few instances. A few brief notes are simply made upon the principal insects of the year. A preliminary list of insects of economic importance was commenced in the "Hawaiian Forester and Agriculturist".

### LANTANA.

A large amount of infected Lantana has been distributed to various inquirers, over the period, and is doing splendid work. The following selected letter is a specimen of the appreciation caused by the work of the lantana destroyers:

MAUI AGRICULTURAL CO., PAIA, MAUI, April 2, 1904.

"Dear Sir: I have been intending for some time to write to you on the good work performed here by the Lantana fly, which destroys the seed. As you may have heard it seems to be everywhere here, on Central Maui, where there is Lantana, and so numerous that a good seed can rarely be found. I understand that it is as numerous in Lahaina and Hana districts as it is here.

"Very truly yours,

"G. A. BALDWIN."

See Haw. For. Agr., vol. I, p. 11, Jan., 1904.

### GUATEMALAN ANTS.

On April 20, 1904, the "Kelep," an ant which promises to be of great usefulness in checking the damage done to cotton by the Cotton Boll Weevil (*Anthonomus grandis*) in Texas and other States, was discovered on cotton in Guatemala.

On reading in a San Francisco paper that the ant had actually been introduced into Texas and had already "saved millions of dollars," I wrote to Dr. L. O. Howard, asking if the introduction was a fact, and if so, would he assist the Bureau in obtaining some individuals upon which to experiment, with a view to observing their behavior in relation to the leaf-hopper. Dr. Howard kindly responded at once, stating that the Coast Journals were misinformed, as the ant had not yet been introduced, and promising his assistance if opportunity offered.

LEPIDOPTERA.

1.—*Carpocapsa* (?) sp.

Seeds of *Acacia koa,* infested by this, were received for determination from the Superintendent of Forestry. It is impossible, however, in the absence of a library, to determine the species bred up.

See Koebele "Notes on Insects affecting the Koa trees at Haiku Forest on Maui," 1901) in Rep. Comm. Agr. Hawaii for 1900, pp. 64-65.

2.—*Cacoecia rosaceana* (Rose leaf-roller).

Reference, W. Saunders, 1900, "Insects Injurious to Fruits," pp. 90-1, text, figs. 89-91.

Specimens of the larvae were sent from Hawaii, with the quest for information as to whether they were Japanese beetles!

*Cacoecia rosaceana* is distributed, I believe, wherever roses, apples, etc., are grown. It feeds also in most stone-fruit trees, currants, gooseberries, strawberries, etc. The larvae are found coiled up in the smaller, tenderer leaves (these furnishing them with shelter and food), which they roll up in the form of hollow cylinders, firmly fastened with silken threads. When full grown they are about three-quarters of an inch long, usually pale greenish in color, with the head and part of the first segment brown, and a darker green stripe along the back, and a few smooth dots on each segment, from each of which there arises a short, fine hair.

"When mature the larva lines the inner surface of its dwelling place with a web of silk, and then changes to a chrysalis of a dark brown color. Toward the end of June, or early in July, with the help of some little thorns on the hinder segments, the chrysalis wiggles itself half way out of the nest, and shortly after the imprisoned moth escapes.

"This is a short, flat moth, resembling a bell in outline when its wings are closed; but when expanded they appear arched on the front edge, curving in a contrary direction near the tip. The body is reddish brown, the fore wings of a light cinnamon-

brown color, crossed with little, wavy, darker brown lines, and with three broad, oblique, dark brown bands, one of which covers the base of the wings and is sometimes indistinct or wanting; the second crosses the middle of the wings; and the third, which is broad on the front edge and narrow behind, is near the outer hind margin. The hind wings are ochre-yellow, with the folded part next to the body blackish. When the wings are expanded the moth measures about an inch across."

The larva is attacked by certain parasitic Hymenoptera, but I do not know whether these are in Hawaii; none hatched out from the larvae sent.

Failing the parasites the best method of controlling this pest would be systematically to inspect the bushes and trees, especially in the cases of rose bushes, and to pinch the curled and twisted clusters of leaves, and incidentally the concealed larvae, taking care that the larvae do not drop out; spraying is of little use, owing to the great difficulty of reaching them.

3.—*Phlyctaenia despecta* (Butler).

*Rhodaria despecta,* Butler, 1877, Ent. Monthly Mag. XIV, p. 49.

*Scopula exigua,* Butler, 1880, ib. XVII, p. 9.

*Scopula despecta,* Meyrick, 1888, Trans. Ent. Soc. Lond., p. 217.

*Phlyctaenia despecta,* Meyrick, 1899, Fauna Haw. I, p. 217.

This is a common and well distributed moth, being found in all the larger islands.

Attempts were made to breed up the larvae, which greatly damage *Ipomoea bona-nox,* but in every case Hymenopterous parasites *(Limnerium hawaiiense)* resulted.

Blackburn described the larva in 1882 as follows: (Ent. Monthly Mag., XIX, p. 56.)

"Convex, broad in the middle and much narrower at the ends; each segment individually also narrowed behind and in front; green, almost unicolorous, save that the dorsal line is darker; a few long hairs on each segment. Feeds in folded leaves of a large convolvulus-like creeper, which grows plentifully on the banks of streams in mountain localities on the Hawaiian Islands."

DIPTERA.

*"Horn-flies."*

These flies have been very troublesome in certain districts and require thorough investigation, but this has not been done owing to the presence of the leaf-hopper problem. Two quite different flies are often confused under the name of "horn-fly"; these are *Stomoxys calcitrans* (the stable fly) and *Haematobia serrata* (the true horn-fly).

The horn-fly clusters in great numbers at the base of the horns of cattle, upon the udder, flanks, and, in fact, anywhere it cannot be easily reached by the animals. It is a blood sucker and its harmfulness lies in its enormous numbers and in the fact that it irritates the animals so that they cannot feed or digest properly, and so a free flow of milk is prevented, and their general condition is poor. As they attack both by night and day, the cattle get no rest.

The eggs are laid in fresh cow-dung and the maggots (larvae) are full grown before this is dry.

The stable-fly is also frequently mistaken for the true house-fly *(Musca domestica)*, which does not bite, but only irritates by everlasting walking over our skin for the purpose of sucking up perspiration, while the stable-fly bites fiercely, even sometimes through trousers and socks. The habits are very similar to those of the horn-flies.

(See also Rep. Minister Interior Hawaii for 1898, pp. 84-7, 1899.)

COLEOPTERA *(Beetles)*.

(1.) Much trouble has been reported as caused by various borers to alligator pear trees and many others, but in the absence of necessary literature these have not been properly determined, nor has there been any opportunity to make investigations on them.

(2.) Japanese Beetle. *(Adoretus umbrosus.)* Repeated applications have been made for beetles attacked by entomophthorous fungus, but owing to the long spell of hot, dry weather, we have not yet been able to establish this here.*

*This has since been well established.

## HEMIPTERA.

### *(Bugs, Scales, Etc )*

(1.) Various scales have been sent in for examination, but nothing new of special importance.

(2.) *Siphanta acuta.* (Walker.) Torpedo bug.

This green-winged, long-pointed leaf-hopper is very abundant on guava and other trees and has lately extended its ravages to coffee at Maunawili. It is destroyed by an entomophthorous fungus, which has also quite recently extended its beneficial ravages to the cane leaf-hopper at Kohala.

## CITRUS CULTURE.

Although not strictly connected with my duties as Inspector, it became very evident to me soon after assuming those duties, that a not inconsiderable loss to the Territory resulted from the neglect of Citrus culture in the Islands and the consequent large importations from California. This impression was deepened by various letters received; I therefore wrote to the Board as follows:

July 1st, 1904.

THE HONORABLE BOARD OF COMMISSIONERS
OF AGRICULTURE AND FORESTRY,
HONOLULU, T. H.

SIRS:—I beg to call the attention of the Honorable Board to a matter which, although lying outside of my strict duties as an Entomologist, has nevertheless come to my knowledge therefrom; I allude to the cultivation, export, and import of Citrus fruits in and from the Hawaiian Islands.

It appears to me very desirable that a Bulletin should be prepared, setting forth the advantages of Citrus cultivation here, and giving full particulars for the use of intending cultivators should be provided.

I beg to suggest this because, although great quantities of these fruits are imported every week, it is also a fact that con-

siderable quantities are shipped, or are proposed to be shipped, to the Coast, a proceeding which appears to me uncommonly like introducing owls into Athens.

On the one hand there were 43 boxes of lemons and limes brought here by the "Alameda" to-day and I suppose that this means some 5000 to 7000 fruits; on the other hand, I received at the end of May a letter from a grower in Hawaii, asking for information re shipping these fruits to the Coast.

It seems indubitable that if it pays California growers to ship these here, it ought to pay a Hawaiian grower to dispose of his produce at home, better than to ship it to the Coast. In fact, I see no reason why any Coast growers at all should find it pay to send over Citrus fruits, as we ought to be able to produce all these here, better and more cheaply.

I trust the Honorable Board will accept this suggestion, although it is a matter that lies outside my regular duties.

Very respectfully,

G. W. KIRKALDY,
Acting Superintendent.

At the meeting held on August 3rd, 1904, the Board adopted the suggestion and requested Director J. G. Smith of the Federal Experiment Station to have a bulletin prepared, dealing with Citrus culture, which, I believe, will shortly appear.

### BATS.

From time to time suggestions have been made on the introduction of various vertebrate animals into these islands for the purpose of preying upon noxious insects.

In May, 1904, Mr. L. G. Blackburn published in the official "Hawaiian Forester and Agriculturist" a recommendation as to the advisability of introducing bats for the above purpose.

Mr. Perkins was thoroughly satisfied that these insectivores would be unqualifiedly beneficial, but was skeptical as to the possibility of successful introduction. (See "Hawaiian Forester and Agriculturalist" for June, 1904, pp. 138-9.)

# REPORT OF ALEXANDER CRAW, SUPERINTENDENT OF ENTOMOLOGY.

HONOLULU, T. H., December 31, 1904.

TO THE HONORABLE BOARD OF AGRICULTURE AND FORESTRY, HONOLULU, T. H.

GENTLEMEN:—I herewith present to you a brief report of work done in your Entomological Department since you placed me in charge of the same, August 12, 1904:

After reviewing the situation and past methods of controling importations along the waterfront, I was convinced that the Territory was not altogether safeguarded against the entry of injurious insects and plant diseases, owing to the location of the principal fumigatory being in the Government Experimental grounds, over a mile from the docks, and the cases and packages of imported trees and plants having to be hauled through a portion of the city, aligned with beautiful homes and grounds containing a great variety of ornamental and economic vegetation. When your attention was called to this danger you gave orders to have the necessary fumigating outfits built on the docks. Four were constructed in the most suitable locations, thereby saving the expense of hauling, as well as reducing the danger of introducing pests. The walls, ceilings, floors and doors are double, with heavy roofing paper between, to make them absolutely gas tight. The doors are wide, to admit the entrance of the largest cases for fumigation before being unpacked for inspection. Two of them are constructed so they can be used for the treatment of plants or seeds that require disinfection with the fumes of carbon bisulphide, instead of the usual fumigation with hydrocyanic acid gas. Root insects, such as borers, Phylloxera, seed and nut infesting weevils, are best treated with the former, as it is a very powerful solvent, destroying the inert pupa within the seed or nut, without injuring their germinating power. Both gases are extremely deadly if inhaled by man or any of the vertebrate animals, on that ac-

count we keep the materials and outfits under lock when in operation. In California quarantine work I used the hydrocyanic gas for the destruction of all noxious imported animals, such as the mongoose, fruit-eating bats, and other prohibited species. It is unquestionably the most expeditious method and resuscitation is impossible.

### INSPECTION.

I retained the services of C. J. Austin as my assistant and we are present upon the arrival of all passenger ships. Mr. Austin personally boards all sailing vessels and looks over the ships' manifest, as well as makes inquiries from officers and crew if they have any plants or fruit. If any such are on board he telephones for me.

### VALUABLE ASSISTANCE.

Under instructions of Collector of Customs E. R. Stackable, the customs officers, when searching the baggage of the passengers, kindly call our attention to any plants, or anything in our line they may find therein, and while a foreign vessel remains in port the guarding officer will not allow such things to be taken ashore unless first passed upon by an officer of your Board. This is a valuable service for the planters, fruit growers and agriculturists of the Territory, and cannot be estimated in dollars and cents, if we may judge by the experiences of the past few years with cane leaf-hoppers, etc.

### IMPORTATIONS.

Since August 12, 1904, exactly one hundred steamers and sailing vessels entered the port of Honolulu from outside the Territory of Hawaii, and brought 54,721 packages of fruits, vegetables and plants, fruits mostly from California.

The principal port of entry for fruits, plants and trees is through Honolulu. But as considerable shipping is done through the ports of Hilo on Hawaii, and Kahului on Maui, I would advise the appointment by your Board of one paid Inspector at each port. Such appointments would be money well

spent in the interest of agriculture and forestry. At the beginning of my duties here numerous receipts of peaches and nectarines were found infected with larvae of *Anarsia lineatella*. In some instances the fruit was destroyed by burning, and others were allowed to be taken on board the steamer again and taken out of the Territory. Lemons and some other fruits have been treated in a similar manner.

Several importers were in the habit of purchasing low grade cheap apples and pears, and disposing of them to cheap restaurants and people at a great profit. This class of fruit is more likely to be infected with insects, and in addition it created the impression that anything would be permitted in the Honolulu markets. Such importers were given to understand that no such cull fruit would be admitted and the result has been the arrival of a better grade of fruit. It is almost impossible to exclude every codling moth worm, as the eggs may have developed after shipment. The codling moth is a very serious pest in apple and pear growing countries, but probably will not damage any of the products of these islands, as it has undoubtedly been imported here for years. Another pest of this character came in on the S. S. "Korea" on September 6th from the Orient, consisting of 10 boxes of sand pears infested with the "Chinese fruit moth worm" *(Laverna herellara)*. This pest is not known on the mainland of the United States, but unfortunately has been introduced into British Columbia. Fumigation has no effect upon a pest of this character, so the fruit and boxes were destroyed by burning. The small worms will enter at any part of the fruit, causing a brown, circular blotch, that soon thereafter decays; specimens have been preserved in dilute formalin.

### FRUIT FLIES.

Fruit-flies are unquestionably the most destructive of all known pests. The melon fly *(Dacus cucurbitae)*, that was unfortunately introduced here a few years ago from Japan, is an example. That pest has practically stopped the production of muskmelons here. It also attacks other melons, besides cucumbers, squash, tomatoes and even string beans.

As other species of this destructive group of flies are known

in other portions of the world, that attack oranges, mangoes, bananas, and even young cocoanuts, you very wisely passed a new regulation (Gen. Circ. No. 2) prohibiting the importation of fresh fruits from certain quarters of the globe into the Territory of Hawaii, which was promptly signed by the Governor.

PLANT IMPORTATIONS.

Since my arrival plants have been received from England, various States of the Union, Ocean Island, Manila, Australia, Peru, and Japan. Scale insects, leaf eating larvae, twig borers, and microscopic leaf eating mites, new species to the Islands, were destroyed, and other plants infested with insects already established here, were thoroughly fumigated and passed. Samples have been preserved for the official collection.

A passenger arrived November 2nd, ex S. S. "Manchuria," having in his possession six small Manila hemp plants *(Musa textiles)*. As the plants were slightly infested with microscopic mites, a species of *Tetranychus,* I burned them. We already have that valuable fiber banana on the Islands and any injurious insect would possibly interfere with its profitable cultivation should it ever be undertaken on Hawaii.

From China we found two baskets of old "white nuts" *(Salisburia adiantifolia)* infested with moth and beetle larvae.

From Japan came three pine trees, the tips of which were infested with Lepidopterous twig borers. On another pine tree from the same country ex S. S. "Mongolia" we found armored scales, *Poliaspis pini,* upon the leaves. With the exception of specimens put up in glass tubes all the above were destroyed.

In two cases of plants from Japan we destroyed five double-flowering prune trees, two flowering cherry trees, infested with the very serious armored scale, *Aulacaspis pentagona.* This scale will withstand the strongest solutions of the best spray mixtures. It is a circular white scale and a very general feeder, infesting fruit trees, tea plants, and a variety of ornamental plants in Japan. Five Camellia plants had the "double scale" *(Aspidiotus duplex)*. This scale burrows slightly under the thin epidermis of the bark and like the "mining scale" *(Howardia biclavis)* it is difficult to detect, having the same

color as the bark. It attacks Orange trees, Azalias, Rhododendrons, Tea and even Camphor trees. Unlike the "mining scale" it succumbs readily to fumigation with hydrocyanic acid gas. But if it is not already found in the Territory we can get along better without, so burned them.

From California came six "Navel" orange trees, on which we found a few "black" and "hemispherical" scales, as we have both species, I fumigated and passed them.

On the S. S. "Doric" from Japan a passenger brought a box of Mammoth chestnuts, that we found to be infested with the larvae of a beetle. A number of the nuts contained from one to eleven larvae in a single nut. The box and contents were burned. Samples of nuts and insects were put up for office specimens. I am not aware that chestnuts are grown on any portion of the Islands, but such insects could possibly adapt themselves to other products.

BY MAIL.

Just before Christmas a package of cotton bolls arrived from Columbus, Georgia. One of the bolls had been burrowed into, evidently by a beetle, and possibly the cotton boll weevil. I, however, have no record of that pest having been found in Georgia, but as it is spreading so rapidly through the Southern States, it is well not to take the risk, as we have a little cotton growing in an experimental way in various portions of the Islands.

The Federal Agricultural Department is evidently looking out for the cotton industry, not only by appropriating a quarter of a million of dollars in an effort to check or stamp out the weevil pest in the South, but by making experiments with cotton in new sections. An instance of this kind is probably under way now, as the S. S. "Sierra," that arrived on December 29th, 1904, brought in six sacks of cotton seed from Florida, consisting of six varieties, fifty pounds of each, consigned to the Federal Experiment Station here. I took the precaution to treat the seed with carbon bi-sulphide fumes. A sample of the Georgia cotton bolls was mounted in a case and is on exhibition in the office.

We have another exhibit that came by mail, showing the danger of introducing pests upon even such small plants as can be transported in that manner. It consisted of eight small Ixora plants from a Philadelphia nursery firm. The leaves were infested with the "thread scale" *(Ischnaspis longirostris)*. This is a serious palm scale and unfortunately has been established on Oahu and probably was introduced in the same way. Only the leaves of the Ixora appeared to be infested, so were removed and plants thoroughly fumigated.

### PROMISED FEDERAL AID.

As the imports of plants and fruits cannot be interfered with until proper entry has been made to the Collector of Customs, and as the docks are in close proximity to cultivated plants, I realized the danger of such freight remaining any length of time without treatment, so addressed the following letter to the Hon. James Wilson, Secretary of Agriculture, Washington, D. C.:

"DEAR SIR:—In order to better protect the Islands against further importation of destructive insect pests and diseases the Board has drafted regulations, under a Territorial Act, prohibiting fruit from countries where fruit-flies are known to exist. Those insects, as you are undoubtedly aware, are the most prolific and disgusting pests that fruit growers have to contend against. In Queensland, Western Australia, Cape Colony, and several other countries it is practically impossible to grow certain fruits. Tropical fruits, such as bananas, mangoes, and even young cocoanuts, in some sections, are not exempt.

Another serious danger to the agricultural and horticultural interests of the Territory is the delay sometimes caused by careless importers in not making prompt entry or application for delivery of such goods. This, of course, does not occur often, but the danger of certain insects developing and escaping from the cases during such delay is certainly very great. This could be avoided if the collector had the authority to grant us the privilege of treating the cases with the necessary amount of hydrocyanic acid gas. This is done after the plants have been passed by the Custom House authorities, so there can be no valid

objections to its more prompt application. The danger of introducing new pests would thus be reduced to a minimum.

"Your knowledge of the enormous danger and loss that has resulted to the horticultural and agricultural interests of the United States through imported insect pests and fungus diseases is the reason I appeal to your department, instead of directly to the Secretary of the Treasury, for the necessary authority to be granted the Collector of Customs of the Territory of Hawaii in the foregoing requests.

"Trusting we may have your valuable co-operation in our efforts to keep out further pests, I remain,

"Respectfully yours,

ALEXANDER CRAW,

"HONOLULU, T. H., Nov. 28, 1904."

The following reply has been received:

"DEPARTMENT OF AGRICULTURE,
"OFFICE OF THE SECRETARY.

"WASHINGTON, D. C., December 12, 1904.

"MR. ALEXANDER CRAW,
DEPARTMENT OF AGRICULTURE,
"HONOLULU, HAWAII.

"DEAR SIR:—I am in receipt of your letter of November 28th regarding steps to be taken to guard against the introduction of insect pests into Hawaii, and note your desire that authority be given the Collector of Customs at Honolulu to grant you the privilege of treating cases of plants with hydrocyanic acid gas.

"We will co-operate with you in the endeavor to obtain from the Treasury Department the desired authority.

"Respectfully,

"JAMES WILSON,
"Secretary."

The necessary authority has since been granted by the Treasury Department.

INTRODUCTION OF PARASITES AND BENEFICIAL INSECTS.

We certainly have more than our share of troublesome bugs and blights, which as far as I can determine are not indigenous to the Hawaiian Islands, but have been brought here upon imported plants without their natural checks. This has been the experience of other countries.

All artificial methods of stamping out, or even controlling, introduced insect pests have proved abortive and the only effective method is that pursued by your Board and the California Board of Horticulture, viz: to send experts to the country from whence came the injurious insect and collect the insects that keep it in check in its native home.

There is positively no risk involved in the introduction of an insect that lives entirely upon other insects, and you cannot any more change their diet than you could that of a tiger to that of a ruminant. So much effective work has been done in this line that it is beyond the experimental stage. However, we must have the true enemy. I have in mind an instance in California where two scales were introduced years ago, one from Australia and the other from Japan. They were both pronounced identical by the foremost scale experts, as no structural difference could be detected, even with the microscope, but a difference in habit was noticeable. The difference that escaped the eyes of man, assisted by the strongest microscopes, does not escape the eyes of a small four-winged parasitic fly—hardly noticeable to the unaided eye—for it would select the one and not the other scale. This shows the importance of having trained and observant men conduct such work, which has raised the value of entomology in aiding the horticulturist and agriculturist in fighting their insect pests.

Too much praise cannot be given such men as Koebele, Compere and Perkins for their valuable research in this line; a work, the character of which takes them to all portions of the world and into climates that are not conducive to health and happiness. Do you wonder that such occupation is not more generally sought after by men trained in entomology?

Some people persist in saying that the only instance where the introduction of beneficial insects has been successful was in

the case of the *Vedalia cardinalis* against the cottony cushion scale. This is not so, for I can refer to at least a score of insects that were formerly very destructive pests and are to-day of no importance, simply because of having been controlled by their natural enemies.

### LEAF HOPPER PARASITES.

I am pleased to chronicle what, in my opinion, will prove to be another ocular demonstration of the value of this work to tillers of the soil.

Less than one year ago you dispatched Messrs. Koebele and Perkins in search of enemies of the destructive cane leaf-hopper *(Perkinsiella saccharicida,* Kirkaldy). The experts went direct to Australia, where it was supposed the leaf-hopper was introduced from on some cane. Several importations of insects came to hand, but it was early in October before what Koebele and Perkins considered the true enemy of the hopper, reached this station, and a few were bred out by the entomologists of the Hawaiian Sugar Planters' Association, when associated in this division. A colony of nine adult parasites, just discernible to the naked eye, were liberated in a cane plantation, where the leaf-hoppers were very numerous, by Mr. F. W. Terry and myself. A few days later nine more issued and as Mr. Terry could not leave I took them to the same plantation and placed them with the others. More parasites issued from subsequent importations and we took them to another field. On December 28th Mr. Terry and I visited both places and I am happy to report to you that we found the parasites established in both locations.

As cane matters are now under the management of the H. S. P. Association at their new quarters, all applications for this parasite will have to go through that station.

### OTHER PARASITES.

Coffee and several other trees are subject to the attack of bugs of the same order as the cane leaf-hopper, but while not as destructive, they nevertheless do considerable damage, more especially to coffee. It is known as the "torpedo bug" *(Si-*

*phanta acuta)*. One of the species of parasites to check the "torpedo bug" is a very minute four-wing fly, that deposits a single egg in the egg of the pest. These were liberated by us in a coffee plantation, but we have not yet had an opportunity to investigate the result.

Two other species of a larger fly that is parasitic upon Siphanta nymphs were received from Koebele and Perkins on December 14th. The first issued on Sunday, December 18th, and were liberated in a coffee plantation by Mr. Kotinsky and me, as we were anxious to give them every opportunity to establish themselves. When we reached the plantation we captured several Siphanta nymphs in a glass tube and it was a most interesting sight to behold how promptly the parasites attacked them, at the same time inserting their ovipositors. The captured "torpedo bugs" and parasites were then liberated. Since then more have been sent out. Mr. W. M. Giffard stated that the manager of the plantation reported to him numbers of young bugs, apparently in a healthy state, but motionless, attached to the leaves. This is characteristic of other similar insects when attacked by internal parasites. The manager understands the life history of the "torpedo bug," so would not be confused by their molted larval skins. This matter will be carefully looked into and if the parasites are breeding they will be sent wherever the "torpedo bugs" are found on the Islands.

### HORN-FLY ENEMIES.

Several lots of "horn-fly" enemies have been received from Koebele and Perkins, but only 15 reached us alive, in rather an enfeebled condition after their long voyage. Mr. Koebele writes me that he will now be able to devote more time to enemies of this pest, as the weather has been too dry for insects of that class.

### SCALE AND APHIS ENEMIES.

Various enemies of scale insects, aphis and other pests, have been received from your collectors and are being carefully bred by Mr. Kotinsky, whose report thereon accompanies this report.

The value and importance to the farmers of Hawaii in saving their crops from destruction by pests, and their bank accounts by the expenditure of their money in a fruitless effort to destroy the pests, convinces me that the Legislature will see that ample funds are appropriated for you to continue the important work of searching for and introducing beneficial insects.

Respectfully submitted,

ALEXANDER CRAW,
Superintendent of Entomology and Inspector.

# REPORT OF JACOB KOTINSKY, ASSISTANT ENTOMOLOGIST.

HONOLULU, T. H., December 31st, 1904.

MR. ALEXANDER CRAW,
Superintendent of Entomology and Inspector,
Honolulu.

SIR:—I have the honor to submit herewith my report for the period of my connection with this office, Sept. 14-Dec. 31, 1904.

I left Washington, D. C., on Sept. 14th, 1904, arriving at Honolulu Sept. 26. While the planters' entomologists were still in this office I took the opportunity to familiarize myself with the nature of the work before me, meantime assisting in the breeding of beneficial insects sent from Australia by Messrs. Koebele and Perkins. Beginning with Oct. 19th, when the second consignment, during my time, arrived, I was installed by you in the breeding room to take charge of the breeding work, which still remains in my care. Gradually it became evident that most of your time and that of the inspector's assistant must be devoted to the important work of inspection. Thus a good deal of the office routine devolves upon me. This includes such as laboratory work, care of collections and apparatus, etc.

## WORK WITH LIVING INSECTS.

The tables appended below will give an approximate idea of the work done with living insects in this office. These do not include, however, the breeding, rearing, study, and observations on injurious insects that were done in the very short period of our tenure of office. Many valuable notes upon life histories and habits of beneficial insects were taken. These will prove useful at some future date, when they are completed, in the publication of bulletins or circulars. As the life cycle of some species extends over a period of years, and as not all the data could be secured during one cycle, it becomes evident that in these instances a number of years must elapse before all the data

will be ready for publication. Fortunately, however, this is not true of many insects in Hawaii, so that complete data upon the most common economic insect fauna will be shortly forthcoming.

### INTRODUCTION AND DISTRIBUTION OF BENEFICIAL INSECTS.

In looking over the table of introductions (pp. 153-155) it will be observed that, in all, 19 species, comprising 500 specimens, most of which are new to the Islands, were introduced since June 22. As a general rule an average of 25% of all sent came alive, the rest having died en route. Considering that the insects for shipment must be collected within as short a time as possible before placing them in cold storage for the long voyage and that these were in most cases only to be found at a railway journey of one or more days from the starting point of the steamer, this may be regarded as a good percentage.

The table of distributions (pp. 156-159) offers even more interesting data. In all 82 colonies were distributed: 18 in October, 24 in November, and 40 in December. Most of the inoculated Japanese beetles were called for in October, as these insects were most troublesome in that month. The effects of the fungus in destroying the beetles became manifest with the advent of rains, and now they are scarce.

This climate is most admirably adapted for the propagation of plant lice, neither is a variety of species of these insects wanting upon these islands, yet, people are scarcely aware of their existence. Any one at all familiar with insect life detects them upon young shoots of orange, etc., though ever accompanied by a strong colony of lady birds in all stages, which soon checks the ravages of the plant lice.

### APPARATUS.

When the Planters' Entomologists vacated it became evident that apparatus facilities were lacking for effective work. These are being obtained.

### LIBRARY.

What was said of apparatus was equally applicable to library facilities at the time of the separation of Territory and Planters'

entomologists. A working entomological library is the entomologist's right hand in his daily work. A list of books absolutely necessary was immediately made up, and they are being procured.

CATALOGUES.

*Library*—To possess a library is one thing, to have this library available is another. Every agricultural experiment station in the world is a source of valuable entomological contributions. In order to be able to lay one's hands on desired information upon a certain insect a card index is inevitable. This is especially true of the entomologist's reports of this country since their appearance here. Numerous insects have been introduced into these islands intentionally and otherwise. Many of these have been recorded in the series of reports, yet, unless one has actually observed them, he cannot be sure that they are here at a moment's notice.

As neither you nor I had the time to devote to this necessary work, a clerk was temporarily engaged for this work. Meantime, as Miss Melika Peterson, the clerk for the Board, was constantly kept busy by the Forestry and Board work, this clerk, Miss C. A. Potter, was employed also in writing and indexing the correspondence of this office.

*Introductions*—Beginning with the first consignment of the last series Messrs. Kirkaldy and Terry, our predecessors in office, have begun recording the introductions of beneficial insects. This is being continued, and the following additional catalogues were inaugurated.

*Distribution of Beneficial Insects*—So far as possible it is advisable to keep records of localities where colonies of beneficial insects were placed in order to avoid duplication of work. The writer deems it advisable to supplement the distribution of beneficial insects by a system of education by means of well illustrated bulletins and circulars. Gradually, as the readers become familiar with the contents and subjects of these publications the work of distribution of well established species by the entomologists of this office will become diminished and they will be able to turn their attention into other useful channels.

*Identifications*—The insects brought by seekers of information are usually injurious and a knowledge of the distribution of

this class of insects over these islands is of vital importance. Hence the catalogue of identifications that has been started. In a way this will show the nature of work that has to be done by this office. An exact determination of the species is essential and this occasionally consumes a great deal of time.

*Card System*—This system was adopted in all the above mentioned catalogues, as it is most readily referred to and places desired information at its seeker's finger ends. Scientists are learning to adapt business methods just as business men are learning the advantages of utilizing scientific experience.

## COLLECTIONS.

A well named and properly arranged collection of insects is one of the essential elements in an entomological office. Unfortunately the collection at the immediate disposal of this office is lamentably poor. With the object in view of building up such a collection, all insects reaching this office, except the live importations, were saved and whenever time permitted, pinned and labeled. Unfortunately, between the work of breeding, office work, and giving information to callers at the office, time was so well consumed that only rarely was I granted the treat of doing museum work. However, there is a good deal of material on hand, and it gradually will be mounted up for comparison and exhibition purposes.

## DIVISION PUBLICATIONS.

Following is a list with brief resumes of Bulletins, Circulars and Articles in the Hawaiian Forester, published by the entomologists:

"The Leaf-Hopper of the Sugar Cane,"

by R. C. L. Perkins.

Bull. 1, Div. Entom., Brd. Comm. Agr. For., T. H., 1903. pp. 38, oct., Honolulu, T. H.

This bulletin gives the history of this insect on these islands, traces its probable native home, and renders an account of its life history and habits, its effects upon the various varieties of cane,

and under variations of treatment of cane. Pages 16-26 are devoted to the leaf-hopper enemies occurring in sugar cane fields, and pp. 26-28 to other insect pests occurring in these fields, concluding with suggestions on means of checking the damage inflicted by the hopper. The Appendix on p. 31 is subdivided into four notes as follows:

NOTE I. Relative Resistance of Leaf-Hopper Eggs to Hydrocyanic Acid Gas, Corrosive Sublimate and Carbolic Acid." (Results of experiments performed by Mr. C. F. Eckart, Director of the H. S. P. A. Experiment Station.)

These were directed against leaf-hopper eggs in seed cane, and corrosive sublimate was found the most effective without injury to the seed.

NOTE II. (pp. 35-36.) "Varieties of Cane."

Seventeen of these are arranged by Mr. Eckart in the order of their powers of resistance to leaf-hopper injury. "Queensland 4" heads the list, and "Yellow Caledonia" concludes it, being the most resistant.

NOTE III is a technical description of a native 4-winged fly (*Ecthrodelphax fairchildii* Perk.), found parasitic upon the sugar cane leaf-hopper.

NOTE IV is likewise technical, consisting of a brief description of the cane leaf-hopper (*Perkinsiilla saccharicida* Kirk.), and a table for the identification of all but one of the known cane leaf-hoppers.

"Later Notes on Lantana Insects"

by R. C. L. Perkins.

Haw. For. Agr., vol. I, pp. 11-13, Jan., 1904.

The author discusses the effectiveness of these insects, by orders, upon the lantana, and the advisability of destroying it.

"On Some Diseases of Cane Specially Considered in Relation to the Leaf-Hopper Pest and to the Stripping of Cane."

R. C. L. Perkins, Press Bull. of the Div. of Entom., Brd. Com. Agr. For., T. H., Apr. 7, 1904.

The author describes the "cane spume," discusses the amount of damage it causes, and the other forms of it present on the Islands and remedies. Brief technical descriptions of the ap-

pearance of the latter are given. A "Preliminary notice of another cane disease" is also here given.

"A Preliminary List of the Insects of Economic Importance Recorded from the Hawaiian Islands," by G. W. Kirkaldy.

Haw. For. Agr., vol. I (1904): June, pp. 152-159; July, pp. 183-189; August, pp. 205-210.—Continued., by Mr. F. W. Terry, l. c., Oct., pp. 273-275; Nov., pp. 299-302, and Dec., pp. 349-352.

With brief remarks here and there on their injuriousness, enemies, etc., the author in this series of articles enumerates the common injurious insects on these Islands. Completed and edited this material will make a useful bulletin, which should be published.

"Instructions to Guide Plantation Managers in the Collection, Transportation and Distribution of the Leaf-Hopper Parasite." Anomalous, Haw. For. Agr., vol. I, pp. 13-14, Jan., 1904.

"How to Liberate and Distribute 'Leaf Hopper' Parasites." Anomalous, Haw. For. Agr., vol. I, pp. 114-115, May, 1904.

"Digest of the Statutes Relating to the Importations of Soils, Plants, Fruits, Vegetables, etc., into the Territory of Hawaii." Gen. Circ. 1, Brd. Com. Agr. For., T. H., 6 pp., oct.

"Important Notice to Ship Owners, Fruit Importers and Others. Rules and Regulations Prohibiting the Introduction of Certain Fruits and Animals into the Territory of Hawaii." Gen. Circ. 2, Brd. Com. Agr. For., T. H., Honolulu, 1904. Approved Oct. 25, 1904.—3 pp., oct.

Respectfully yours,

JACOB KOTINSKY,
Asst. Entomologist.

# LIST OF BENEFICIAL INSECTS COLLECTED FOR THE BOARD OF AGRICULTURE AND FORESTRY BY MESSRS. KOEBELE AND PERKINS IN THE AUSTRALIAN COLONIES, AND INTRODUCED INTO HAWAII, June 21—Dec. 31, 1904.

COLEPTERA (Beetles, Ladybirds)

| Name | No. Rec'd alive | Date 1904 | Steamer | Feeds on | Notes |
|---|---|---|---|---|---|
| *Verania frenata* | 100 | June 29 | Aorangi | Aphis | Released on sugar cane plantation |
| *Verania frenata* | 50 | Oct. 19 | Miowera | Aphis | Released on sugar cane plantation |
| *Verania frenata* | 4 | Nov. 17 | Moana | Aphis | Retained for breeding in laboratory |
| *Verania frenata* | 20 | Dec. 6 | Ventura | Aphis | Released in Honolulu |
| COCCINELLIDAE— | | | | | |
| Miscellaneous | ? | June 21 | Sierra | Aphis and Coccids | Released in Honolulu |
| Miscellaneous | 14 | Dec. 14 | Aorangi | Coccids | Retained for breeding in laboratory |
| Miscellaneous | 13 | Dec. 27 | Aorangi | Aphis and Coccids | Released in Honolulu |
| Miscellaneous (tiny, shining black) | 40 | Dec. 6 | Ventura | Coccids | Retained for breeding in laboratory |
| Miscellaneous (black, red spot on each wing cover) | 25 | Nov. 17 | Moana | Aphis | Retained for breeding in laboratory |
| Miscellaneous (black, red spot on each wing cover) | 20 | Dec. 6 | Ventura | Aphis | Released in Honolulu |
| Miscellaneous (black, red spot on each wing cover) | 13 | Dec. 14 | Aorangi | Aphis | Retained for breeding in laboratory |
| Miscellaneous (small, dark, brownish) | 15 | Nov. 17 | Moana | Coccidae | Retained for breeding in laboratory |
| Miscellaneous (small, dark, brownish) | 20 | Dec. 6 | Ventura | Coccidae | Released in Honolulu |
| *Coelophora pupillata* | 1 | Dec. 14 | Aorangi | Aphis | Released in Honolulu |
| *Cryptolaemus montrouzieri* | 3 | Oct. 19 | Miowera | Mealy bugs | Placed in breeding jar for this species |
| *Cryptolaemus montrouzieri* | 1 | Dec. 14 | Aorangi | Mealy bugs | Released |
| Dung beetles | 20 | Oct. 19 | Miowera | Maggots in dung | Released on a cattle ranch near Honolulu |
| *Leis conformis* | 12 | June 29 | Aorangi | Aphis | |
| *Leis conformis* | 31 | Oct. 19 | Miowera | Aphis | Released some on sugar plantation |

# LIST OF BENEFICIAL INSECTS COLLECTED FOR THE BOARD OF AGRICULTURE AND FORESTRY BY MESSRS. KOEBELE AND PERKINS IN THE AUSTRALIAN COLONIES, AND INTRODUCED INTO HAWAII, June 21—Dec. 31, 1904.—(Continued).

COLEPTERA (Beetles, Ladybirds)

| Name | No. Rec'd alive | Date 1904 | Steamer | Feeds on | Notes |
|---|---|---|---|---|---|
| *Leis conformis* | 10 | Nov. 17 | Moana | Aphis | Oahu in Honolulu; sent to Hawaii, etc. |
| *Leis conformis* | 40 | Dec. 6 | Ventura | Aphis | Some are still under observation in the laboratory. |
| *Leis conformis* | 81 | Dec. 14 | Aorangi | Aphis | |
| *Leis conformis* | 65 | Dec. 27 | Sierra | Aphis | |
| *Neda testudinaria* | 2 | Dec. 6 | Ventura | Cane hopper | Referred to H. S. P. A. entomologists. They report having obtained eggs from these. |
| *Orcus bilunulatus* | 2 | Oct. 19 | Miowera | Lecanium (?) | Retained for breeding in laboratory |
| *Orcus bilunulatus* | 2 | Nov. 17 | Moana | Lecanium (?) | Retained for breeding in laboratory |
| *Orcus cyanocephalus* | a few | Aug. 22 | Sierra | Aphis | Retained for breeding in laboratory |
| *Orcus cyanocephalus* | not given | Sept. 13 | Sonoma | Aphis | Released on sugar cane plantation |
| *Orcus cyanocephalus* | a few | Sept. 21 | Aorangi | Aphis | Released on sugar cane plantation |
| *Orcus cyanocephalus* | not given | Oct. 4 | Ventura | Aphis | Released on sugar cane plantation |
| *Orcus lafertei* | 3 | Dec. 6 | Ventura | D. nipae (?) | These were immature and died subsequently. |
| *Orcus lafertei* | 3 | Dec. 14 | Aorangi | D. nipae (?) | Retained for breeding in laboratory |
| *Orcus lafertei* | 1 | Dec. 27 | Sierra | D. nipae (?) | Retained for breeding in labortory |
| *Platyomus Koebelei* | 17 | Nov. 17 | Moana | Coccidae | Retained for breeding in laboratory |
| *Platyomus Koebelei* | 18 | Dec. 6 | Ventura | Coccidae | Retained for breeding in laboratory |
| *Platyomus Koebelei* | 19 | Dec. 14 | Aorangi | Coccidae | Retained for breeding in laboratory |
| *Platyomus Koebelei* | 1 | Dec. 27 | Sierra | Coccidae | Retained for breeding in labortory |
| *Platyomus lividigaster* | 2 | Dec. 14 | Aorangi | Aphis | Released |
| *Scymnids* (tiny, shining; and black with 2 red spots) | 140 | Oct. 19 | Miowera | Coccidae(?) | Some released, others retained in laboratory |

# LIST OF BENEFICIAL INSECTS COLLECTED FOR THE BOARD OF AGRICULTURE AND FORESTRY BY MESSRS. KOEBELE AND PERKINS IN THE AUSTRALIAN COLONIES, AND INTRODUCED INTO HAWAII, June 21—Dec. 31, 1904.—(Continued).

### HYMENOPTERA (Internal Parasites)

| Name | No. Rec'd alive | Date 1904 | Steamer | Feeds on | Notes |
|---|---|---|---|---|---|
| *Chalcid* | | Oct. 19 | Miowera | Mealy bugs | Several reared and released on alligator pear scale in Honolulu |
| *Chalcid* | | Oct. 19 | Miowera | Siphanta eggs | Over 100 reared and distributed on Oahu |
| *Dryinus* (roundish pupa) | 19 | Dec. 14 | Aorangi | Siphanta nymphs | All those reared released on coffee plantation on Oahu |
| *Dryinus* (elongate pupa) | 5 | Dec. 14 | Aorangi | Siphanta nymphs | All those reared released on coffee plantation on Oahu |

### NEUROPTERA (Lace wing flies)

| Name | No. Rec'd alive | Date 1904 | Steamer | Feeds on | Notes |
|---|---|---|---|---|---|
| *Chrysopa* | 2 bred | Dec. 14 | Aorangi | Scale, aphis, etc. | 2 bred out and released on scale infested alligator pear trees in Honolulu |

### LEPIDOPTERA (Moths)

| Name | No. Rec'd alive | Date 1904 | Steamer | Feeds on | Notes |
|---|---|---|---|---|---|
| *Thalpochares sp.* | | Oct. 19 | Miowera | Presumably scale | A number of males and females bred and released on scale infested alligator pear trees in Honolulu |
| *Thalpochares sp.* | some 10 bred | Nov. 16 | Moana | Presumably scale | A number of males and females bred and released on scale infested alligator pear trees in Honolulu |

# COLONIES OF INSECTS AND FUNGUS DISTRIBUTED FOR THE BOARD OF AGRICULTURE AND FORESTRY BY THE DIVISION OF ENTOMOLOGY DURING THE THREE MONTHS, OCTOBER-DECEMBER, 1904.

COLEOPTERA (Beetles, Ladybirds)

| Name | Number | Date 1904 | Feeds upon | Locality |
|---|---|---|---|---|
| *Verania frenata* | 50 | Oct. 25 | Aphis | Sugar Cane, Waipahu, Oahu |
| *Verania frenata* | 9 | Oct. 25 | Aphis | Honolulu, Oahu |
| *Chilocorus circumdatus* | 12 | Nov. 20 | Armored scales | Waialua, Oahu |
| *Chilocorus circumdatus* | 12 | Dec. 13 | Armored scales | Olaa, Hawaii |
| *Chilocorus circumdatus* | 27 | Dec. 27 | Armored scales | Olaa, Hawaii |
| *Coccinella repanda* | 12 | Nov. 20 | Aphis | Waialua, Oahu |
| *Coccinella repanda* | 5 | Dec. 12 | Aphis | Honolulu, Oahu |
| *Coccinellidae* (mixed) | 15 | Dec. 31 | Mealy bugs | Honolulu, Oahu |
| *Coelophora pupillata* | 4 | Dec. 13 | Aphis | Olaa, Hawaii |
| *Cryptolaemus montrouzieri* | 36 | Nov. 3 | Mealy bugs | Wahiawa, Oahu |
| *Cryptolaemus montrouzieri* | 12 | Nov. 3 | Mealy bugs | Kapiolani Park, Honolulu |
| *Cryptolaemus montrouzieri* | 25 | Nov. 4 | Mealy bugs | Tantalus, Oahu |
| *Cryptolaemus montrouzieri* | 25 | Nov. 20 | Mealy bugs | Waialua, Oahu |
| *Cryptolaemus montrouzieri* | 25 | Nov. 20 | Mealy bugs | Sisal, Oahu |
| *Cryptolaemus montrouzieri* | 25 | Nov. 22 | Mealy bugs | Kohala, Hawaii |
| *Cryptolaemus montrouzieri* | 40 | Dec. 1 | Mealy bugs | Wahiawa, Oahu |
| *Cryptolaemus montrouzieri* | 8 | Dec. 12 | Mealy bugs | Honolulu, Oahu |
| *Cryptolaemus montrouzieri* | 12 | Dec. 13 | Mealy bugs | Waikiki, Oahu |
| *Cryptolaemus montrouzieri* | 2 | Dec. 23 | Mealy bugs | Kaimuki, Oahu |
| Dung beetles | 20 | Oct. 20 | Horn fly and other maggots | Waialae, Oahu |
| *Leis conformis* | 25 | Oct. 25 | Aphis | Waipahu, Oahu |
| *Leis conformis* | 7 | Oct. 27 | Aphis | Honolulu, Oahu |
| *Leis conformis* | 6 | Nov. 20 | Aphis | Waialua, Oahu |
| *Leis conformis* | 100 | Nov. 22 | Aphis | Kohala, Hawaii |
| *Leis conformis* | 35 | Nov. 22 | Aphis | Waipahu, Oahu |
| *Leis conformis* | 1 | Nov. 28 | Aphis | Honolulu, Oahu |

# COLONIES OF INSECTS AND FUNGUS DISTRIBUTED FOR THE BOARD OF AGRICULTURE AND FORESTRY BY THE DIVISION OF ENTOMOLOGY DURING THE THREE MONTHS, OCTOBER-DECEMBER, 1904.—(Continued).

COLEOPTERA (Beetles, Ladybirds)

| Name | Number | Date 1904 | Feeds upon | Locality |
|---|---|---|---|---|
| *Leis conformis* | 13 | Dec. 10 | Aphis | Honolulu, Oahu |
| *Leis conformis* | 24 | Dec. 12 | Aphis | Honolulu, Oahu |
| *Leis conformis* | 12 | Dec. 27 | Aphis | Honolulu, Oahu |
| *Leis conformis* | 12 | Dec. 28 | Aphis | Waipahu, Oahu |
| *Leis conformis* | 12 | Dec. 29 | Aphis | Makaweli, Kauai |
| *Leis conformis* | 12 | Dec. 29 | Aphis | Eleele, Kauai |
| *Leis conformis* | 12 | Dec. 29 | Aphis | Honolulu, Oahu |
| *Orcus chalybeus* | 1 | Dec. 13 | Aphis | Honolulu, Oahu |
| *Platyomus lividigaster* | 25 | Nov. 20 | Aphis | Waialua, Oahu |
| *Platyomus lividigaster* | 2 | Dec. 12 | Aphis | Honolulu, Oahu |
| *Rhizobius* (?) mixed | 12 | Nov. 22 | Aphis and scale | Kohala, Hawaii |
| *Rhizobius ventralis* | 40 | Dec. 13 | Scale insects | Olaa, Hawaii |
| *Rhizobius ventralis* | 7 | Dec. 13 | Scale insects | Waikiki, Oahu |
| *Rhizobius ventralis* | 6 | Dec. 23 | Scale insects | Kaimuki, Oahu |
| *Scymnidae*, mixed | 25 | Oct. 20 | Scale insects | Honolulu, Oahu |
| *Scymnus vividus* | 12 | Dec. 1 | Scale insects | Wahiawa, Oahu |
| *Scymnus vividus* | 30 | Dec. 13 | Scale insects | Olaa, Hawaii |
| *Scymnus* (?) (brownish) | 25 | Dec. 27 | Scale insects | Honolulu, Oahu |
| *Scymnus* (?) (tiny, black) | 25 | Dec. 27 | Scale insects | Honolulu, Oahu |
| *Vedalia cardinalis* | 25 | Nov. 2 | Cottony cushion scale | Moanalua, Oahu |
| *Vedalia cardinalis* | 25 | Nov. 4 | Cottony cushion scale | Tantalus, Oahu |
| *Vedalia cardinalis* | 20 | Nov. 22 | Cottony cushion scale | Kukuihaele, Hawaii |
| *Vedalia cardinalis* | 9 | Dec. 12 | Cottony cushion scale | Honolulu, Oahu |
| *Vedalia cardinalis* | 12 | Dec. 13 | Cottony cushion scale | Kahuku, Oahu |
| *Vedalia cardinalis* | 10 | Dec. 13 | Cottony cushion scale | Honolulu, Oahu |
| *Vedalia cardinalis* | 7 | Dec. 22 | Cottony cushion scale | Honolulu, Oahu |
| *Vedalia cardinalis* | 12 | Dec. 31 | Cottony cushion scale | Waimanalo, Oahu |

## COLONIES OF INSECTS AND FUNGUS DISTRIBUTED FOR THE BOARD OF AGRICULTURE AND FORESTRY BY THE DIVISION OF ENTOMOLOGY DURING THE THREE MONTHS, OCTOBER-DECEMBER, 1904.—(Continued).

### HYMENOPTERA (Internal Parasites)

| Name | Number | Date 1904 | Feeds upon | Locality |
|---|---|---|---|---|
| *Chalcidae* . . . . . | 2 | Oct. 20 | Par. on mealy bug.. | Honolulu, Oahu |
| *Chalcidae* . . . . . | 1 | Oct. 27 | Par. on mealy bug.. | Honolulu, Oahu |
| *Chalcidae* (?) . . . . . | 24 | Oct. 21 | Siphanta eggs ..... | Nuuanu Valley, Oahu |
| *Chalcidae* . . . . . | 36 | Oct. 22 | Siphanta eggs ..... | Nuuanu Valley, Oahu |
| *Chalcidae* . . . . . | 30 | Oct. 27 | Siphanta eggs ..... | Nuuanu Valley, Oahu |
| *Chalcidae* . . . . . | 6 | Oct. 30 | Siphanta eggs ..... | Nuuanu Valley, Oahu |
| *Chalcidae* . . . . . | 17 | Nov. 1 | Siphanta eggs ..... | Nuuanu Valley, Oahu |
| *Dryinus* (roundish pupae) ..... | 2 | Dec. 19 | Siphanta nymphs ... | Waimanalo, Oahu |
| *Dryinus* (roundish pupae) ..... | 11 | Dec. 21 | Siphanta nymphs ... | Waimanalo, Oahu |
| *Dryinus* (roundish pupae) ..... | 9 | Dec. 22 | Siphanta nymphs ... | Waimanalo, Oahu |
| *Dryinus* (roundish pupae) ..... | 5 | Dec. 24 | Siphanta nymphs ... | Waimanalo, Oahu |
| *Dryinus* (elongate pupae) ..... | 3 | Dec. 31 | Siphanta nymphs ... | Waimanalo, Oahu |

### LEPIDOPTERA (Months)

| | | | | |
|---|---|---|---|---|
| *Thalpochares* sp. . ..... | 4 | Nov. 7 | Scale insects ..... | Honolulu, Oahu |
| *Thalpochares* sp. . ..... | 4 | Nov. 9 | Scale insects ..... | Honolulu, Oahu |
| Lantana leaf-miners . .....hundreds | | Dec. 29 | Lantana leaves .... | Eleele, Kauai |

### NEUROPTERA (Lace-wing flies)

| | | | | |
|---|---|---|---|---|
| *Chrysopa* (?) sp. ..... | 2 | Dec. 23 | Scale insects, etc.... | Honolulu, Oahu |

### HEMIPTERA (Bugs)

| | | | | |
|---|---|---|---|---|
| Tingid . . ..... | 200 | Dec. 29 | Lantana leaf ..... | Eleele, Kauai |

## COLONIES OF INSECTS AND FUNGUS DISTRIBUTED FOR THE BOARD OF AGRICULTURE AND FORESTRY BY THE DIVISION OF ENTOMOLOGY DURING THE THREE MONTHS, OCTOBER-DECEMBER, 1904.—(Continued).

FUNGUS (Mould)

| Name | Number | Date 1904 | Feeding upon | Locality |
|---|---|---|---|---|
| Fungus infected beetles | 50 | Oct. 20 | Japanese beetles | Kaimuki, Oahu |
| Fungus infected beetles | 50 | Oct. 21 | Japanese beetles | Kaimuki, Oahu |
| Fungus infected beetles | 50 | Oct. 21 | Japanese beetles | Honolulu, Oahu |
| Fungus infected beetles | 60 | Oct. 27 | Japanese beetles | Honolulu, Oahu |
| Fungus infected beetles | 70 | Oct. 28 | Japanese beetles | Manoa Valley, Oahu |
| Fungus infected beetles | 100 | Oct. 31 | Japanese beetles | Waimanalo, Oahu |
| Fungus infected beetles | 60 | Nov. 1 | Japanese beetles | Sisal, Oahu |
| Fungus infected beetles | 50 | Nov. 4 | Japanese beetles | Tantalus, Oahu |
| Fungus infected beetles | 50 | Nov. 4 | Japanese beetles | Honolulu, Oahu |
| Fungus infected beetles | 50 | Nov. 7 | Japanese beetles | Honolulu, Oahu |
| Fungus infected beetles | 50 | Dec. 1 | Japanese beetles | Honolulu, Oahu |
| Fungus infected beetles | 12 | Dec. 17 | Japanese beetles | Hoopuloa, South Kona, Hawa |
| Fungus infected beetles | 22 | Dec. 22 | Japanese beetles | Makaweli, Kauai |

# AGRICULTURE.

## REPORT OF JARED G. SMITH CONCERNING AGRICULTURAL WORK DONE AT THE FEDERAL EXPERIMENT STATION DURING 1904.

The Territorial Legislature appropriated, at its special session in June, 1904, the sum of $228.00 per month to assist the Hawaii Experiment Station.

The sum expended from July 1 to Dec. 31, 1904, totals $1509.32, as follows:

| | | |
|---|---|---|
| For wages of Foreman at the Station at $50.00 per month | | $300 00 |
| For partial payment of salary of Chemist, at $16.66 per month | | 83 00 |
| For wages of one white laborer at the Station, at $37.50 per month | | 222 50 |
| For a portion of the expense of the tobacco experiments in Hamakua | | 903 82 |
| This item includes Wages of Superintendent at $5.00 per day | $585 00 | |
| Lumber and supplies | 318 82 | |
| Total | | $1509 32 |

This Station has been in process of formation for four years. In the beginning we had nothing but a piece of rocky land,—a narrow strip over two miles in length, the unforested portion thickly covered with Klu, Lantana and Guava,—set aside for the purposes of an experiment station by the Governor of Hawaii. There were no buildings, fences, laboratories, no tools to work with and no land cleared. The larger share of the appropriations made by Congress for this Station during the past four years have been used in getting together an equipment, a place to work and something to work with. The experiments carried

on and the bulletins and reports published have been accomplished rather in spite of obstacles than with outside assistance and support. If the Station can live through until July 1, 1905, we will at the beginning of the fiscal year 1906 be provided with a moderate equipment so that beginning on that date the Station ought to be able to put a larger proportion of the available funds into the work of investigation and experiment.

### NEW BUILDINGS.

The Station is indebted to the Territory for its fine new fireproof Library, Laboratory and Office building, a concrete buildnig with iron roof, 60 x 35 feet. Three thousand dollars was provided by the Legislature for this building, and about two thousand was expended from the Federal funds. The Legislature contributed $1,500.00 for a new dwelling. The Station also supplied some of the funds for this structure.

The Station now has on the reservation near Honolulu, one concrete laboratory building, for the Chemist and Horticulturist; one laboratory and insectory for the Entomologist; four dwellings; seven laborer's quarters; stables and outbuildings; one-half mile wire fencing; over 6,000 feet water pipes, 3 in., 2 in., and 1 in.; tanks holding 45,000 gallons of water; and, improvements in the form of roads, trails, grading and the partial or complete clearing of a portion of the farm. The Station owns one work horse, one carriage horse and one saddle horse; and one mule at Hilo.

### TOBACCO.

This Station has 1 1-4 acres of tobacco at Pohakea, in Hamakua. One acre has been covered with tent cloth. There is a good equipment in the way of tool shed and seed beds. A small shed originally intended for a tool house has been used for a curing barn. This entirely inadequate structure is now being enlarged so that we expect to be able to handle the next crop of leaf in something like a commercial method.

A report in regard to the Hamakua tobacco experiment is in preparation and will probably be ready for publication in about one month. As this experiment has been a co-operative one, a

large share of the expense having been borne by the Territory, I would suggest that the bulletin be published jointly, either as a Station bulletin of the regular series or as a bulletin of the Board of Agriculture.

An account of the tobacco experiment to date has been published in a recent number of the Hawaiian Forester and Agriculturist.

The results of the first year's work indicate strongly that Hawaii can grow high class cigar tobacco of both wrapper and filler types.

The Station has leased five acres of land near Hilo, which is now being planted with cacao and bananas.

### BANANAS.

Quite an extended study of bananas has been made during the last year, some of the results of which are embodied in Bulletin No. 7 of the Station. This study has included methods of cultivation and marketing; soils for banana culture; and a test of thirty or forty varieties of this fruit. A collection of these varieties is planted on the Station experimental plots and also on lands at Hilo under our control.

A number of experiments have been started to determine the relative merits of different methods of cultivation, planting and fertilization. Many different combinations of fertilizing ingredients are being used, the results of which experiments should not only point with strong probability to the kinds of fertilizers which the growers should use but should teach those who are growing bananas under like conditions to determine with certainty the fertilizers needed in their particular locality. From the cultural standpoint experiments are in progress with deep and shallow planting, with large and small holes in a well cultivated field, with plants cut off a few inches above the corm or root-stock and plants not cut, with the planting of sun-dried suckers and those fresh from the plant, and other similar problems. The questions implied in all of these experiments are yet unsettled, difference of opinion prevailing even among those who have had much experience in the culture of this crop.

The shipment of Bluefield bananas received early in January was planted at the Station, and multiplied there.

We have on hand 145 Bluefield bananas in Honolulu, and 130 in Hilo. These are all the property of the Board. The bananas were received at this Station January 1, 1904. One hundred and ten of the 325 corms planted grew or threw out suckers. With the exception of six plants which have been reserved for fruiting, all the plants are being treated to make them throw out new suckers as rapidly as possible. There has been an increase of 165 during 1904

### MANGOES.

It is desired to make quite extensive studies of the mango. Some experiments in propagation have been proceeding for several months. Encouraging success and instructive failures have followed experiments in budding this species of fruit-tree. Enough has been done to show the practicability of the process but much more must be done to determine the best methods to follow.

Between thirty and forty varieties of mangoes have been studied. A more detailed study of many of these should be made to discover their respective merits for the different purposes for which mangoes are used. Some of these varieties are doubtless of commercial value and a trade in the finer sorts can undoubtedly be built up in the mainland markets. A mango nursery is being established on the Station grounds for propagation and other experiments.

A devastating mango disease, causing the destruction of the young leaves, the flowers and the fruits has been present in the islands for some time. Last year the mango crop was nearly a complete failure in parts of the islands, largely due to this disease. This blighting effect has been attributed to various causes but it is unquestionably due to a parasitic fungus. The Station has had the matter under study and observation and at the present time experiments are being conducted to determine the best means to control the attacks. The fungus has been determined by the micologists of this Department to be a species of *Colletotrichum* and is comparatively new to science.

### THE AVOCADO, OR ALLIGATOR PEAR.

Much the same work is necessary in the case of the Avocado pears as is being attempted with the mango. Even less is known

about budding and grafting this fruit tree than is known of the mango. Yet this method of propagation is of even more importance for the Avocado, for it is wholly unreliable when propagated from seed. There are very many varieties of this fruit growing in different parts of these islands and some are of very excellent quality. If these can be propagated by a simple method of grafting or of budding, it will be possible to establish orchards of trees giving a uniform production of fruit. There is no certainty that a seedling tree will produce a crop of even fair fruit. A small nursery of Avocado pears is being established on the experimental plots of the Station and propagation work will be pursued. An experimental orchard of about one hundred mango and Avocado trees is in a flourishing condition on the mauka lands of the Station tract where the Eucalyptus trees were cut away in 1901, giving them a chance to grow. This orchard partly grown and ready for experimental use is a valuable adjunct to the Station equipment.

### CITRUS FRUITS.

It is a well known fact that very large importations of Citrus fruits come into the islands annually. This should not continue in a country so well adapted to citrus culture. Many species and varieties of citrus fruits have been in the islands for years and have done well when given a fair chance. In fact some make a fair showing for themselves even under most adverse conditions. A bulletin, giving simple cultural instructions, for those who wish to grow citrus fruits, will soon be issued by this Station. It is intended also to make a study of the relative adaptability of stocks for different citrus fruits under our local conditions. This is a work involving patient study through many years.

### CACAO.

The Station controls five acres of land in Hilo for experiments in the production of Cacao. Three acres have already been prepared for the planting of Cacao trees. Bananas have been planted for shade, which is so necessary for this crop. Three acres have been divided into five sections in which the different varieties of Cacao will be tested and experiments conducted in different methods of cultivation and in propagation by budding and

grafting. Two of these Sections have already been planted. Among other experiments, one is being tried to test the advantages or disadvantages of very close planting with a view to cutting out about half or three-quarters of the trees after they have produced several crops and require more space. In one section the trees are being set 7 1-2 feet apart in the rows and the rows the same distance apart. After the second or third years' crop, the number of trees will be gradually reduced so that eventually they will stand 7 1-2 x 15 feet or perhaps 15 x 15 feet. By this means it may be possible to get a much larger product from a plantation during the first years of its growth.

There is a theory to the effect that the fruitfulness of a Cacao tree will be greatly decreased if its tap-root be cut off or injured in any way. This theory has been challenged by some experienced planters who claim that the opposite is sometimes the case, but the matter is yet unsettled. It is quite possible that this difference of opinion may be accounted for by varying soil conditions. Since it may be a matter of great importance to those who may go into Cacao culture here, this matter will be made the subject of careful study and experiment.

### RUBBER.

Rubber is now attracting considerable local attention. This Station has been desirous of doing some experimental work in aid of this industry but up to the present time it has not been possible to undertake it because of lack of means. A few different kinds of rubber producing plants have been grown and some considerable study has been given to the industry as conducted elsewhere. There will be many local problems connected with the industry here, which the Station wishes to undertake if funds are available. It is designed to publish a brief press bulletin giving simple cultural instructions.

### PLANT BREEDING.

This branch of horticultural science has made rapid advancement during the past few years. Many new and valuable creations in plant life are appearing every year. By proper cross-fertilization and hybridization and by judicious selection

it is possible to produce almost any desired form within reasonable limits. It is highly desirable that work of this kind should be done here. As an example of the problems which might present themselves, we may cite the present local situation relative to the rice industry. The rice grown here does not meet the demands of the Japanese taste and consequently thousands of dollars worth of rice are being imported and the local industry is being threatened. The Japanese rice does not seem to be adapted to local conditions. The task of the plant breeder would be to create a variety approximating the Japanese form, but suited to the environment which it would find in Hawaii.

Other of our local needs are watermelons, muskmelons, squashes, pumpkins. cucumbers, etc., which would be resistant against the attack of the melon-fly. It is not at all impossible that such varieties could be originated by breeding to produce a hard rind.

Up to the present time lack of facilities and the limited means at the disposal of the Station have rendered such work impossible.

## MISCELLANEOUS WORK.

At the Station investigations are being made relative to Hawaiian Tan Barks; the cultivation of Cassava for Starch and Glucose; experiments with Bananas; the nature and method of control of the Mango disease; the chemical composition of Grasses and Forage plants; grafting and budding the Mango and Alligator Pears; Silk raising; Citrus fruits; insects injurious to crops other than Cane, and the relation of humus to fertility.

The H. S. P. A. Experiment Station, with their magnificent equipment of buildings and laboratories and their large and able staff of scientists are amply able to care for all Cane interests in Hawaii.

The Board of Agriculture and Forestry is well equipped with men and means to care for Insect Quarantine and Forestry problems.

The Hawaii Experiment Station cannot afford to attempt any of the work in connection with Cane, Forestry or Insect

Quarantine. Our equipment is not sufficient, our staff is small, our funds too limited.

There are, however, a number of important lines of investigation which would well repay the expenditure of a much larger Territorial stipend than has thus far been given us. I respectfully request the support of the Board to the end that a larger appropriation can be given us.

### TOBACCO.

I would like an appropriation of $3000.00 per annum for two years for a continuation of the Tobacco experiment at Pohakea, and an extension of Tobacco cultivation to other districts in the Islands where suitable Tobacco soils exist. I believe that two years more will be sufficient to demonstrate absolutely the practicability of Tobacco culture, up to the point where we can say to those who have capital to invest that good Tobacco can be produced provided proper methods are employed and the proper kinds are planted.

### SILK.

I would like an appropriation of $1500.00 per annum for the purpose of demonstrating the practicability of producing raw Silk in Hawaii. In Japan, China and Italy, the three foremost Silk producing countries of the world, the Silk Worms are cared for in the homes of the laborers by the women and children of the household. The men are employed in other work. The production of raw Silk is not considered sufficiently remunerative to engage the time of the whole household.

I believe that the promotion of the care of Silk Worms by the families of plantation laborers on lands above the cane would lead ultimately to more stable labor conditions on the plantations, in that the formation of home communities would, in a measure, attach the laborer more closely to the soil. If a moderately remunerative home occupation can be provided for the women and children so that the laborer will be content to stay in one locality, the plantations would be able to get and keep a steadier and more reliable class of laborers in their employ.

An appropriation for this purpose would need to be exempted from the clause of the law relative to the employment of Asiatics by the Government, both because we would have to employ Japanese as instructors in the art of Silk culture, and because the laborers who would benefit from the establishment of this industry would be mainly of that nationality.

### COFFEE.

I would like an appropriation of $1500.00 per annum for two years for an investigation of certain phases of the Coffee industry.

If Coffee were sold in the world's markets in accordance with merit as determined by aroma and flavor I believe that Hawaiian Coffee would be at the top of the list. We can grow Coffee in Hawaii. There is no trouble on that score. The average yield per tree in Hawaii in about three times what it is in Brazil.

But unfortunately fashion, not merit, rules the price of Coffee. A rather large proportion of our Coffee, when properly graded, closely resembles the best grades of Java in shape and size of berry. But there is a marked difference in the color and odor of the two. Color and odor are apparently what the buyers of fancy Coffee are willing to pay for. The grading, cleaning and polish of the berry, and even the cupping qualities of the roasted article are subordinate. A certain shade of color and a certain odor have come to be associated in the minds of Coffee experts with "Old Government Java" or "Old Mocha." If we could, by proper methods of fermentation and manipulation, get into our Hawaiian Coffee the peculiar dirty yellowish brown color and Oriental smell, our Hawaiian Coffee could be sold for double the price which it now commands. I believe that this is possible, and that it would pay to attempt it.

### HORTICULTURE.

I would like an appropriation of $1000.00 per annum for two years to continue experiments which we have made in the shipment of Mangoes, Papaias and Alligator Pears and other

tropical fruits in cold storage to the Eastern markets. We have made one shipment of Alligator Pears to New York in cold storage. Some of the fruit got through in good shape, some not. We were able to keep pears in cold storage seven weeks in Honolulu without deterioration in flavor or texture. The points to be worked out are the best temperatures and the methods of packing for storage and shipment. I believe that it is possible to work up a good market on the mainland for tropical fruits, and that successful experiments will lead to the development of a profitable commercial industry, capable of almost indefinite extension.

### GREEN HOUSE.

A green house for culture and propagation experiments in horticultural investigations, such as the study of Fungus diseases of cultivated plants; the cross pollination of Flowers for the production of new varieties, and the propagation of economic plants for more general distribution throughout the Islands. Such a structure would cost about $3000.00. The resources of the Station will not permit the erection of a green house for some years to come. It is absolutely necessary for economy of time and effort that a plant house be provided as soon as possible.

### IRRIGATION.

Irrigation and agriculture are almost synonymous terms in all the leeward districts of Hawaii. Without water for irrigation during the dry summer months practically nothing can be grown. This Station is very much in need of an improved water supply. If a reservoir were constructed at the 850 foot level on the Station Reservation it would enable us to be independent of the Honolulu Water Works. During the last three years there has been a shortage of water, even at times for household purposes, during the summer months, so that no plot or field experiments requiring the use of water have been possible.

To provide an adequate water supply for irrigation of crops I would like an appropriation of $10,000.00 for the construc-

tion of a 3,000,000 gallon reservoir just below the forest on the upper part of our reservation.

To recapitulate, I respectfully request the support of the Board of Commissioners of Agriculture and Forestry in obtaining from the Territorial Legislature appropriations for this Station as follows:

| | Per Annum. |
|---|---|
| Tobacco work | $ 3,000 00 |
| Silk culture | 1,500 00 |
| Coffee | 1,500 00 |
| Cold storage of fruits | 1,000 00 |
| A total of | $ 7,000 00 |
| And for a green house | 3,000 00 |
| For a reservoir | 10,000 00 |

This would make a total appropriation for the biennial period of $27,000.00, a less sum than is appropriated by Congress.

JARED G. SMITH,
*Special Agent in Charge of Hawaii Experiment Station.*

# SECOND REPORT

OF THE

# BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY

OF THE

# TERRITORY OF HAWAII.

FOR THE YEAR ENDING DECEMBER 31, 1905.

HONOLULU:
HAWAIIAN GAZETTE CO., LTD
1906.

# BOARD OF AGRICULTURE AND FORESTRY

**FOREST AND ORNAMENTAL TREE SEED AND SEEDLINGS FOR SALE AT THE GOVERNMENT NURSERY.**

**The Division of Forestry keeps constantly on hand at the Government Nursery, seed and seedlings of the important native and introduced trees. These are sold at prices just covering the cost of collection or growing.**

**The list includes both forest and ornamental trees, such as Silk Oak, Koa, various species of Eucalyptus, Golden and Pink Shower, Pride of India, Poinciana, Albizzia, etc. The price of the seed varies from 10 to 50 cents per ounce. The seedlings may be had for 2½ cents each, except a few kinds which are 5 cents. Seed of the various palms is also for sale; the price per 100 varying from $1.00 to $2.50. All seed is tested before being sent out, which insures its being good.**

**All communications in regard to seed or trees should be addressed to David Haughs, Forest Nurseryman, Box 331, Honolulu, Hawaii.**

**RALPH S. HOSMER,**
**Superintendent of Forestry.**

## NOTICE FROM THE DIVISION OF ENTOMOLOGY.

The Entomological Division of this Board wishes to inform Hawaiian readers of this report that it is always ready and anxious to receive, study and report upon any insects that they may find and submit. When feasible either colonies of beneficial insects will be sent, or simple, inexpensive remedies will be prescribed. No charge.

OFFICE BUILDING.

# SECOND REPORT

OF THE

# BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY

OF THE

# TERRITORY OF HAWAII.

FOR THE YEAR ENDING DECEMBER 31, 1905.

HONOLULU:
HAWAIIAN GAZETTE CO., LTD.
1906.

# OFFICERS AND STAFF

OF THE

# Board of Commissioners of Agriculture and Forestry

## 1906

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In coöperation with the Hawaii Experiment Station,
JARED G. SMITH, *Special Agent in Charge.*

### CLERKS AND STENOGRAPHERS

MISS ELIKA PETERSON
MISS ELLA K. DAYTON

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# BOARD OF AGRICULTURE AND FORESTRY.

## Report of the Commissioners.

To the Governor of the Territory of Hawaii:

The Board of Commissoners of Agriculture and Forestry of the Territory of Hawaii hereby makes report of the status and acts of this Board for the year 1905.

### NEW LEGISLATION.

During the year 1905 the following legislation has been enacted relating to the duties of the Board of Agriculture and Forestry, viz:

1. Act 65 of the Laws of 1905 amends section 379 and 381 of the Revised Laws. The gist of the amendment is, that, whereas under the previous statute it required an act of Legislature to take lands out of a forest reserve, the amendment allows such removal to be made by the Governor, with the approval of the Commissioner of Public Lands, after a public hearing, to consider the advisability of such action.

2. Act 71 of the Laws of 1905 provides for the protection of forest land from fire; the appointment of fire wardens, prescribes their powers and fixes penalties for violation of the act.

3. Act 82 of the Laws of 1905 adds a division of animal industry to the divisions heretofore under the jurisdiction of the Board. In general, the act provides for the appointment of a Superintendent of animal industry; gives the Board powers to obtain and disseminate information relating to animals, their production and diseases; to make rules and regulaitons governing their importation, inspection, quarantine and disinfection, and suppression of disease, with other incidental powers.

4. Act 12 of the Legislature of 1905 made a special appropriation of $2,000 for the suppression of forest fires. The im-

mediate occasion of such appropriation was the existence of a serious fire in South Kona. The appropriation was all expended, together with a small additional amount from the general fund.

## MEETINGS OF THE BOARD.

During the year 1905 the Board held one executive and sixteen regular meetings, in addition to committee meetings. Three special meetings were also held jointly with the Governor, for the purpose of considering the setting apart of proposed forest reserves.

## RULES AND REGULATIONS ADOPTED DURING 1905.

New rules and regulations have been passed by the Board as follows:

### *Rule 1.—Inspection of Imported Live Stock.*

In order to prevent the introduction into this Territory of infectious, contagious and communicable diseases among live stock and other animals, local managers or agents of Steamship and Navigation lines or the commanding officer of any ship shall notify the Territorial Veterinarian or the local Live Stock Inspector immediately upon the arrival of any ship, of the presence on board, if any, of live domestic animals, including poultry and dogs, when same is intended to be landed in this Territory, and shall upon arrival of any ship furnish the inspecting officer with a list of the number and kind of animals taken on board from any port outside of this Territory, the number and kind destined for the Territory, the names of the owners or consignees, and a report as to the condition of health and cases of sickness or death among the animals while on board.

If necessary to remove such animals before the arrival of the inspector, they must be confined on the pier in such a manner as to facilitate inspection, but should in no case be turned loose on the pier. Hogs and sheep shall be confined in temporary pens. Cattle and horses shall be tied on the pier. No animal of any description shall be allowed to leave the pier

LIBRARY ROOM, BOARD OF AGRICULTURE. MEETING ROOM OF THE BOARD AND KINDRED ORGANIZATIONS.

until the Territorial Veterinarian or local Live Stock Inspector has issued a certificate of health permitting the landing of the animal or animals in question.

In no case shall the removal of live animals from the ship for inspection or other purposes, constitute a landing until a certificate of health for such animals has been issued.

Until further notice the ports of Honolulu, Oahu, and Hilo, Hawaii, shall constitute the only ports of entry for live stock and other animals for this Territory.

Any violation of this regulation is a misdemeanor.

This regulation shall take effect at once.

*Rule 2.—Inspection and Testing of Imported Live Stock for Glanders and Tuberculosis.*

In order to prevent the further introduction of glanders and farcy into this Territory, it is hereby ordered that:

No horse stock, (including mules and asses), shall be admitted to the Territory unless accompanied by a certificate of health showing that the animal or animals in question have been submitted to the mallein test and found to be free from glanders. Said test must be made and certificate issued by a competent veterinarian whose name appears upon the list of graduates from a recognized veterinary college and whose professional standing is satisfactory to this Board. The test must be made according to the rules of the Territorial Veterinarian and recorded on blanks furnished by him for this purpose.

If such animals shall not have been tested before shipment they shall upon arrival in this Territory be placed in quarantine and held there until mallein tested under the supervision of the Territorial Veterinarian or the local Live Stock Inspector and at the expense of the owner.

Any person contemplating the importation of horse stock to this Territory shall notify the Territorial Veterinarian or the local Live Stock Inspector and obtain from him the necessary blanks and instructions.

In order to prevent the further introduction of tuberculosis in cattle it is hereby ordered, that:

No cattle above the age of six months shall be admitted to the Territory unless accompanied by a certificate of health

showing that the animal or animals have been submitted to the tuberculin test and found to be free from tuberculosis. The said test must be made under the same conditions as those governing the importation of horse stock and be recorded on blanks furnished by the Territorial Veterinarian. If unaccompanied by such certificate the animals shall be tested upon arrival in the same manner as prescribed for horse stock.

If any horse stock shall be found by the Territorial Veterinarian or the local Live Stock Inspector, upon arrival in the Territory, to be infected with glanders or any cattle to be infected with tuberculosis, the same shall be immediately destroyed and the carcass disposed of at the expense of the owner, under the supervision of the Territorial Veterinarian or the local Live Stock Inspector.

Any violation of this regulation is a misdemeanor.

This regulation shall take effect at once.

*Rule 3.—Concerning Glandered Horse Stock in the Territory.*

It having been brought to the notice of this Board that a contagious disease known as glanders and farcy prevails among the horse stock in various portions of this Territory; therefore, in case any animal shows symptoms of glanders, the owner or person having charge of the same, or any person having reason to believe or to suspect that an animal has glanders shall immediately notify the Territorial Veterinarian or the local Live Stock Inspector.

If the Territorial Veterinarian or the local Live Stock Inspector decides that there is reason to believe an animal is suffering from glanders he shall at once isolate the suspected animal or animals and either submit them to the mallein test or remove them to quarantine, where they shall be kept under observation until the nature of the disease can be definitely established.

All animals which upon examination by the Territorial Veterinarian or the local Live Stock Inspector are found to exhibit definite symptoms of glanders shall be destroyed and the carcasses disposed of under the supervision of one of the above mentioned officers.

All other animals which have been exposed to the infection by being in the same stall, yard or premises, or which in any way have come in contact with an affected animal, shall be quarantined for such period as shall be required by the Territorial Veterinarian or the local Live Stock Inspector, or submitted to the mallein test.

The premises where affected animals have been kept shall be disinfected under the supervision of the Territorial Veterinarian or the local Live Stock Inspector.

All expenses in connection with the examination, testing, destroying and disposing of affected animals, as well as quarantine and disinfection, shall be paid by the owner.

Any violation of this regulation is a misdemeanor.

This regulation shall take effect at once.

## PUBLICATIONS DURING 1905.

### *Division of Forestry.*

Press Bulletin No. 1.—List of Forest and Ornamental Tree Seed for sale at Government Nursery. 3 pp. April, 1905. (1,000 copies.)

Press Bulletin No. 2.—Suggestions in regard to the Arbor Day Tree Planting Contest. 7 pp. October, 1905. (750 copies.)

Circular No. 1.—An Offer of Practical Assistance to Tree Planters. 6 pp. December, 1905. (2,000 copies.)

### *Division of Entomology.*

Circular No. 1.—A Circular of Information. 8 pp. April, 1905. (2.500 copies.)

Circular No. 2.—The Japanese Beetle Fungus. 4 pp. December, 1905. (1,000 copies.)

### *Division of Animal Industry.*

Rule 1.—Inspection of Imported Live Stock.

Rule 2.—Inspection and Testing of Imported Live Stock for Glanders and Tuberculosis.

Rule 3.—Concerning Glandered Horse Stock in the Territory. 1 page each. September, 1905.

## DIVISION OF FORESTRY.

The division of forestry has continued to be under the supervision of Mr. Ralph S. Hosmer, as Superintendent, with Mr. David Haughs as Assistant and Nurseryman. The district foresters have, with a few changes, remained the same as those previously in office. A list of the district foresters and fire wardens and their several jurisdictions are given in the Forester's report.

### FOREST RESERVES.

During the year, three more forest reserves, aggregating 190,469 acres, have been established, of which 38,844 acres were government land free of leases, which have been set apart for forest purposes.

The three reserves named are respectively at Hilo, Hawaii, containing 110,000 acres; Koolau, Maui, containing 42,969 acres; and Halelea, Kauai, containing 37,500 acres.

Other reserves on several different Islands are in process of reservation and will be set apart at an early date.

One cause of delay in setting apart reserves is, that in order to prevent future question as to exact location and boundary the Board has adopted the policy of not setting apart reserves until a definite detailed survey of the boundaries can be obtained. As most of the reserves are in mountainous and forested country, this is slow and difficult work.

### GOVERNMENT LAND IN RESERVES.

An amendment to the forestry law in regard to the government land which may be set apart as a forest reserve, is urgently needed.

Under the existing law no government land can be set apart as a forest reserve on which there is more than a two years lease. This provision does not work well. A large number of government lands, covered with forests, which everybody agrees should be made into a forest reserve, are under long leases. The authority should be given to place this land in the forest reserve, subject to the existing leases. There would then be a certainty that when the existing leases expired there

would be a definite area retained in forests. Under the existing statute the government lands which can be placed in forest reserves are in patches, with intervening pieces of government land still under leases, left in a state of uncertainty as to whether they will eventually be reserved or not. This uncertainty produces a deterrent effect upon private land owners who, if they were certain that adjoining government lands were to be retained as forest reserves, would also place their lands under the forest reserve act.

An effort should be made at the next session of the Legislature to secure the repeal of the above referred to provision, so that the Governor may set government lands apart as a forest reserve whether the same are under lease or not, to take effect upon the termination of the leases.

Several large private land owners are now negotiating with the Board for the turning over of their forest lands to the control of the Board under the terms of the forestry law.

## FOREST EXTENSION.

Next to establishing forest reserves, to preserve the still existing natural forests, the reforesting of denuded areas is of the most importance. The lack of any appropriation for this purpose has prevented any actual planting of trees by the Board during the past year. It is caring for the young trees near the Pali, planted during the previous year. In the course of another year these will be large enough so that they will need but little attention.

A number of private persons and corporations are doing good work in forest planting.

## SEED DISTRIBUTION.

One difficulty in connection with forestry extension either by the Board or by private parties has been the inability to get fresh seeds. At slight expense the Board has adopted the policy of gathering a large variety of seeds of beneficial trees growing in the Islands and selling them to applicants at cost. Lists of the seeds on hand and the prices are published from time to time.

The free distribution of plants and trees was discontinued last year, and it was hoped that local nurserymen would take up the planting and furnishing of young trees. This has not been done, however, to any extent, and to meet the constant demands for young trees, the Board has planted the seeds of valuable trees at the nursery and furnished them to all comers at cost. No plants or trees which can be obtained from nurserymen are planted and sold by the Board. During the year 1905, 16,159 trees and plants were distributed.

The free distribution of plants has been limited to furnishing them to schools for Arbor Day use and to public grounds and for streetside purposes.

## ADVICE AND SUGGESTIONS.

The Board has also adopted the policy of furnishing free advice as to the best variety of trees for different localities; the method of establishing nurseries and of planting out and caring for young trees, and of supervising the establishment of tree nurseries.

A large number of calls have been made upon the Board for services of this kind, and we hope that the public in an increased degree will take advantage of the opportunity.

## RUBBER.

The interest in rubber has greatly increased during the past year, there being now three organized rubber companies planting trees on the windward coast of Maui. The Ceara variety has done the best so far and grows the quickest. A large number of seeds have been collected by the Board and distributed. Mr. Jared G. Smith, of the Federal Experiment Station, has also imported and distributed a number.

With the assistance of Professor A. Koebele of this Board, two dozen Castilloa rubber trees were obtained from Mexico and have been set out in the upper Moanalua Valley through the courtesy of Mr. S. M. Damon. They are doing fairly well there. It is intended to take cuttings from these trees for distribution, as propagation by seeds is difficult owing to their short life. Out of about 4,000 seeds brought from Mexico by

Mr. George R. Ewart and presented to the Board, only one or two have so far germinated.

## ECONOMIC FORESTING.

An erroneous opinion prevails among many people that a forest reserve means the locking up from economic use of a certain forest area.

Conservation of water is one of the principal objects of creating forest reserves; but in many cases there is no direct conservation of water involved; while in many other cases the conservation of water is entirely consistent with the removal of the older trees, if carefully and intelligently done, and providing the heavy fern undergrowth is not unduly disturbed. Under such circumstances the cutting out of the old forest trees is of positive advantage, in that it gives the young trees a chance to grow, while at the same time producing a profit from the forest. This statement is made with the proviso that cattle are not allowed on the ground, as they will eat up or trample down nearly all the young trees and ferns which grow in the Hawaiian forests.

The Board has welcomed the opportunity to demonstrate that its forest policy is not merely a locking up one, by the request of the Bishop Estate for advice concerning the proposed lumbering of a Koa forest back of the Volcano House.

Forester Hosmer responded to this request by making a careful examination of the forest in question and making a full report approving such proposition, with suggestions as to guarding and protecting the younger growth. The owners of the forest are now proceeding in accordance with the suggestions made by Mr. Hosmer, with every prospect of creating a valuable industry.

## FOREST FIRES.

Forest fires have occurred during the year in North and South Kona, Hawaii, and at Wahiawa and Waianae Uka, on Oahu. The most serious one in results was at Wahiawa, Oahu, where a large amount of valuable Koa forest on the Wahiawa watershed was destroyed. Although no general appropriation

has been provided for extinguishing fires, and private assistance has been required to extinguish them, the Board is of opinion that the fire law passed by the last Legislature has been of much benefit, in that it has brought distinctly to the attention of the public that setting fire to the forests is prohibited; and further in providing a fire warden, authorized to take authorative action, in each district.

### ARBOR DAY.

The year 1905 saw the first actual observance in Hawaii of Arbor Day, November 3rd having been set apart by School Superintendent J. C. Davis to be observed by the schools as Arbor Day.

The Governor later issued an official proclamation setting apart the day and recommending its observance. The Government Nursery furnished 3,554 trees for use by the schools in the observance of the day.

### REPORTS OF FORESTER AND DISTRICT FORESTERS.

The reports of Forester R. S. Hosmer, of Nurseryman Haughs and of a large number of the District Foresters are printed herewith, and will be found to contain a large amount of interesting and valuable detail.

## DIVISION OF ENTOMOLOGY.

The staff of this division continues the same as last year, viz: Alexander Craw, Superintendent and inspector; A. Koebele, consulting entomologist; J. Kotinsky, assistant entomologgist; C. J. Austin, inspector's assistant.

### QUARANTINE WORK.

The quarantine against dangerous insect pests has continued to be efficiently enforced by the division of entomology.

It is highly desirable that an expert plant pathologist should be appointed to study, and provide means to protect the country against fungus diseases, many of which have already been introduced.

Regulations have been passed preventing the importation of fruit from the Asiatic and South Pacific ports, as these ports are known to be infected with fruit flies of various kinds which are among the most destructive insect enemies of fruit. This Territory knows to its cost that the melon fly has practically exterminated the musk melons, once so plentiful here, and has rendered difficult and expensive the production of the watermelon.

Other fruit flies are known to have almost destroyed the entire fruit industry of South Africa and to have almost exterminated a number of fruits in Australia. Dangerous fruit flies are known to exist in China and Japan, which have not yet been introduced into these Islands.

In addition to the fruit flies, large numbers of other insect pests and diseases of fruit are known to exist in the Asiatic and South Pacific countries and the commercial importation of fruit from these countries is almost certain to introduce these pests here in spite of the most rigid quarantine and disinfection.

During the course of the year, several attempts have been made to import fruit in spite of the law, but the officers of the Board have done their duty against all opposition.

One shipment, consisting of 2,950 cases of oranges, was brought from China and Japan. In addition to their importation being in violation of the rules prohibiting all importation of fruit from Asia, they were found to be seriously infected with a large number of insect pests. They were ordered destroyed, and were destroyed. The importers brought legal proceedings to try and prevent it, and failing in so doing, suit for damages was brought and is still pending in court.

The Board desires to express its appreciation of the prompt and efficient support given to it in this connection by the Attorney General, E. C. Peters.

## DANGEROUS REPTILES.

In June last an importation of fourteen live snakes, including six rattlers, was made for exhibition purposes. At that time as there was no regulation in existence against the intro-

duction of snakes, the question arose as to whether the powers of the Board were sufficient to exclude them. The immediate question was settled by several individuals buying the snakes and killing them. They now form an exhibit in the Board museum. This instance was made the basis of a request from the Board to Secretary Wilson to issue a regulation prohibiting the introduction of snakes into Hawaii, which was done on the first of August last.

## MAIL IMPORTATIONS.

A considerable number of plants and seeds are imported through the mail. Unofficial permission had heretofore been given to the Inspectors of the Board to examine mail of this kind. During this year official authority has been granted by the United States postal officials to allow the inspectors of the Board to inspect, and if necessary, destroy or disinfect fruit, seeds or plants coming through the mails.

## BENEFICIAL PARASITES.

The work of collecting, propagating and distributing parasites of injurious insects has steadily continued during the year. Messrs. Koebele and Perkins when recently abroad primarily investigating parasites of the cane Leaf Hopper, also collected a number of beneficial insects which prey upon scales and other insects injurious to general agriculture. Considerable attention also has been paid to parasites of the Horn Fly, several of which have been introduced.

The work of propagating the beneficial insects after their importation has been ably attended to by Mr. Jacob Kotinsky, of the staff.

The work of identifying insects and making collections thereof for future reference has gone steadily on. The Board has now a very fair beginning of a collection of Hawaiian insects and their parasites.

## VISITS OF INSPECTION.

The members of the Board staff have made trips to the districts other than Honolulu as often as their time would permit. The routine duties of the office are so great, however, that this

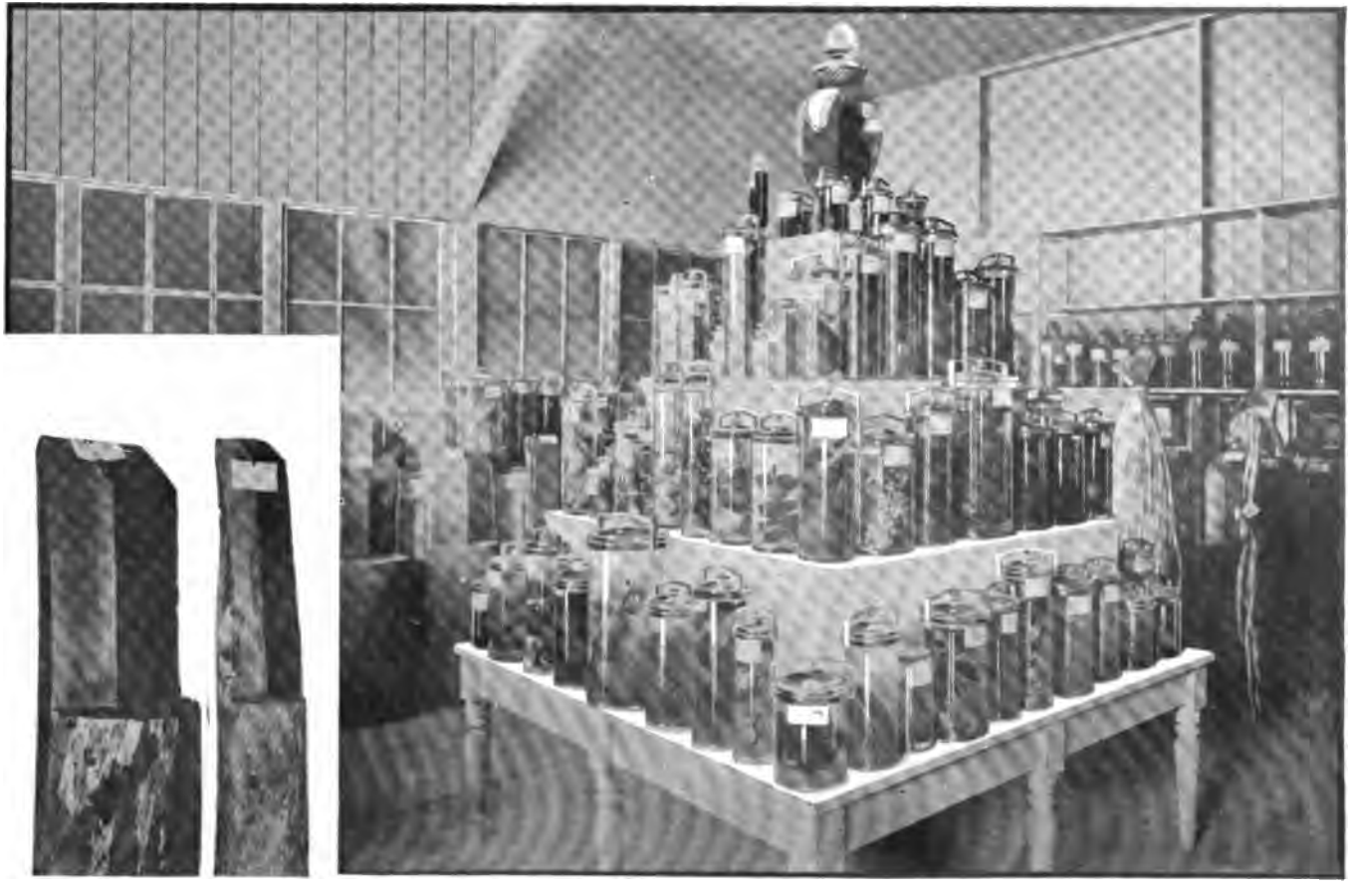

EXHIBIT ROOM, BOARD OF AGRICULTURE AND FORESTRY. COLLECTIONS OF NATIVE AND ISLAND GROWN WOODS AND FRUITS.

work has not been as fully attended to as should be the case; but until there is a larger staff as much time has been spent in this way as the Board felt was reasonably practicable.

## DIVISION OF ANIMAL INDUSTRY.

The act creating the division of animal industry was enacted on April 26, 1905.

The appropriation made available for the superintendent of animal industry being insufficient to secure separate services of a competent man, an arrangement was made with the Federal Government and with the Hawaiian Live Stock Breeders' Association, by which they jointly with this Board engaged the services of Dr. Victor A. Norgaard to act as the United States Inspector of Animals for the Territory of Hawaii, Veterinary Adviser to the Breeders' Association and Superintendent of the Division of Animal Industry, under the title of "Territorial Veterinarian."

Dr. Norgaard is an expert veterinarian and was for a number of years connected with the Bureau of Animal Industry at Washington, D. C. He took office under the Board on July 1, 1905, and has accomplished much in the brief period of his incumbency of the office. Dr. Norgaard has spent a good deal of his time in traveling about the Islands inspecting stock and getting acquainted with local conditions. A most serious condition was found among horse stock, a comparatively large number of cases of glanders coming to light. He also found scabies seriously affecting a number of flocks of sheep.

An important discovery by him, is, that one of the principal reasons why most of the animals in Hawaii, more particularly cattle and horses, are small in stature, is, that there is an insufficiency of lime in some of the pasturage, causing a disease known as "Osteomalacia," or softening of the bones. The same trouble in other countries has been met by feeding lime, chiefly in the form of bone meal, to the animals. Under Dr. Norgaard's direction this has been tried on several of the cattle ranches with gratifying success. Dr. Norgaard's account of his discovery and experiments in this connection, printed herewith, will be found of extreme interest to all interested in live stock.

## REGULATIONS CONCERNING ANIMALS.

Under Dr. Norgaard's advice the Board has passed three regulations, viz: One, requiring live stock imported into the Territory to be inspected and restricting importations of live stock to the ports of Honolulu and Hilo; two, a regulation requiring the mallein test to be administered to all horses and mules imported to the Islands and the tuberculin test to be administered to all cattle imported into the Territory; three, a regulation relating to the examination, quarantine and destruction of all glandered horses found in the Territory.

In this connection Dr. William F. Egan of San Francisco, California, has been designated by the Board as one whose certificate as to administration of the mallein and tuberculin tests would be accepted by this Board. He is paid no salary by the Board, compensation for his services being made by the importers.

Importers are not compelled to have the tests made at San Francisco, they being permitted to wait and have the tests made here if they so choose.

As a matter of fact, it has been a great help to importers to have the stock inspected before shipment, instead of after, as they thereby save the freight if the animal is found diseased. Since the passage of this regulation, practically all horses and cattle coming into the Territory have been tested in San Francisco, and in one or two cases only has disease appeared upon them after arrival here.

In connection with the regulations above mentioned, circulars describing Glanders and Farcy have been printed and circulated by the Board throughout the Territory.

A comparatively large number of cases of Glanders have been discovered and destroyed, and with proper assistance in inspection and a continuance of rigid quarantine upon importations there is no reason why Glanders should not eventually be stamped out from the Territory, if enough assistance can be obtained. The existing appropriation is so small that thorough work cannot be done.

## ANIMAL QUARANTINE STATION.

An animal quarantine station has been established at Kalihi with appropriate buildings and a care taker. All suspicious cases requiring quarantine or treatment are cared for at this station.

## TREATMENT OF SHEEP.

A considerable portion of the Veterinarian's time has been taken up in the dipping of sheep to eradicate scabies. There are aproximately 100,000 sheep in the Territory, and during the past year the veterinarian has personally superintended 40,000 dippings of sheep.

His services are at all times available to sheep owners to supervise dipping operations. By repeating the operation several times, one of the ranches where the disease was worst has nearly succeeded in eradicating it.

## HORN AND SCREW WORM FLIES.

Among the chief enemies of live stock in the Territory, noted by the veterinarian, are the Horn Fly and the Screw Worm Fly. Both are troublesome and the cause of heavy loss among live stock. A more particular study of the habits and parasites of these flies is desirable and is being carried on as fully as the division force will permit.

Another disease prevalent among horses, found by Dr. Norgaard, is closely akin to a mild form of glanders, but is different therefrom in a number of respects, more particularly in that many cases seem to be curable, which is not the case with glanders. Detailed examination by Dr. Norgaard of some 4,000 horses on the Island of Hawaii showed that there was very little of the disease on the plantations, but that among the other horses, more particularly those of the poorer class, from 25 to 30% were affected with this disease, which Dr. Norgaard calls "Chronic Nasal Catarrh," or "Pseudo Glanders." It is comparatively unknown in other countries, so

that there is little literature and but little known about the subject. For the purpose of studying this and other diseases and their remedies a much larger and better library and laboratory than at present possessed by the Board is needed.

An appropriation for this purpose is urgently required.

### TUBERCULOSIS IN CATTLE.

An examination of a number of herds of cattle has revealed the fact that there is but little tuberculosis to be found among the cattle of the Territory.

Owing to the large amount of detailed work required and the limited amount of assistance available in making tuberculin tests, no attempt has been made as yet to make a complete examination of the cattle of the Territory. This should be done and will be undertaken as rapidly as possible. Funds enough to employ additional assistance in this connection are necessary.

### ASSISTANCE TO THE VETERINARIAN.

Dr. Harold B. Elliot of Hilo, has been appointed by the Board as animal inspector at that port, and in addition to the duties of that office has rendered valuable voluntary assistance to the Board.

The Board is strongly of the opinion that an immense amount of good has been done to the live stock industry in the Territory in the creation of the division of animal industry, and that no better person could have been selected to fill the office of Territorial Veterinarian than the present incumbnt.

## DIVISION OF AGRICULTURE.

In order not to duplicate work, the agricultural division of work in the Islands is carried on by the Federal Experiment Station and the detail of the work accomplished by it is contained in its annual statements. The most important work done by that station during 1905 has been the continuing of the tobacco experiment station at Hamakua. The experiment has met with a high degree of success. Tobacco of good qual-

ity and in quantity per acre, amply sufficient to make it commercially profitable, has been produced. Examination of the product by a number of tobacco experts resulted in the verdict that the best samples would market either in Europe or the United States as the best high grade tobacco. That the percentage of the high grade article was not greater is undoubtedly due to lack of experience in curing the tobacco. It is hoped that a tobacco curing expert may be secured to handle the crop of 1906. That any of the tobacco produced is high grade, is proof that experience and care is all that is necessary to produce more of the same kind.

The work of the Experiment Station in connection with tobacco has now brought the question to a point where it is up to those who wish to engage in the business from a commercial standpoint to take hold. The station has demonstrated that a high quality of commercial tobacco can be produced in Hawaii and that large areas of land are suitable therefor. A full statement of the results achieved, written by Mr. Jared G. Smith, chief of the Experiment Station, is included in this report.

Respectfully submitted,

LORRIN A. THURSTON,
C. S. HOLLOWAY,
W. M. GIFFARD,
A. W. CARTER,
J. F. BROWN,
J. D. DOLE,
Commissioners.

# APPROPRIATIONS FOR BOARD OF AGRICULTURE AND FORESTRY, PASSED BY THE LEGISLATURE AT THE SPECIAL SESSION OF 1904, FOR THE SPECIAL FISCAL PERIOD, JULY 1, 1904, TO JUNE 30, 1905.

*Second 6 months—January 1 to June 30, 1905.*

SALARIES AND PAY ROLLS.

| | Appropriation for period. | Amount on hand Jan. 1, 1905. | Amount Drawn. | Amount Unexpended June 30, 1905. |
|---|---|---|---|---|
| Salary of Superintendent of Forestry | $ 3,000.00 | $1,500.00 | $1,500.00 | $ 0.00 |
| Pay of Assistants Laborers and Rangers, Division of Forestry | 2,700.00 | 1,357.90 | 1,350.00 | 7.90 |
| Salary of Superintendent of Entomology | 3,000.00 | 1,548.39 | 1,500.00 | 48.39 |
| Pay of Assistants, Inspectors and Employees, Division of Entomology | 7,280.00 | 3,854.80 | 3,850.50 | 4.30 |
| Salary of Clerk and Stenographer | 900.00 | 450.00 | 450.00 | 0.00 |
| | $16,880.00 | $8,711.09 | $8,650.50 | $60.59 |

CURRENT EXPENSES.

| | | | | |
|---|---|---|---|---|
| Incidentals and General Expenses | $11,780.00 | $ 9,041.15 | $8,654.98 | $386.17 |
| Rebate through error in books | | | | 7.51 |
| | | | | $393.68 |
| Assistance to Federal Experiment Station | 2,736.00 | 1,226.68 | 1,226.68 | 0.00 |
| | $14,516.00 | $10,267.83 | $9,881.66 | $393.68 |

ADDITIONAL APPROPRIATIONS.

| | | | | |
|---|---|---|---|---|
| Suppression of Forest Fires | $ 2,000.00 | ..... | $1,999.65 | $ 0.35 |
| Unpaid Bills | 81.30 | ..... | 81.30 | 0.00 |

# APPROPRIATIONS FOR BOARD OF AGRICULTURE AND FORESTRY, PASSED BY THE LEGISLATURE AT THE EXTRA SESSION OF 1905, FOR THE BIENNIAL PERIOD, JULY 1, 1905, TO JUNE 30, 1907.

*First 6 months—July 1 to December 31, 1905.*

SALARIES AND PAY ROLLS.

| | Appropriation. | Drawn. | Balance. |
|---|---|---|---|
| Salary of Superintendent of Forestry | $ 6,000.00 | $ 1,500.00 | $ 4,500.00 |
| Pay of Assistant Laborers and Rangers, Division of Forestry | 4,000.00 | 990.00 | 3,010.00 |
| Salary of Superintendent of Entomology | 6,000.00 | 1,500.00 | 4,500.00 |
| Pay of Assistants, Inspectors and Employees, Division of Entomology | 5,000.00 | 1,240.00 | 3,760.00 |
| Salary of Clerk and Stenographer. | 1,800.00 | 450.00 | 1,350.00 |
| Salary of Territorial Veterinarian. | 1,400.00 | 350.00 | 1,050.00 |
| Pay of Assistants, Inspectors, Employees and Laborers of Division of Animal Industry | 1,000.00 | 65.00 | 935.00 |
| | $25,200.00 | $ 6,095.00 | $19,105.00 |

CURRENT EXPENSES.

| | | | |
|---|---|---|---|
| Incidentals and General Expenses and Experimenting in Growing Rubber Trees on Government Forest Lands | $29,848.00 | $ 5,241.02 | $24,606.98 |
| Assistance to Federal Experiment Station | 5,472.00 | 1,731.05 | 3,740.95 |
| Incidentals and General Expenses, Bureau of Animal Industry | 250.00 | 147.75 | 102.25 |
| | $35,570.00 | $ 7,119.82 | $28,450.18 |

# DIVISION OF FORESTRY.

## Report of the Superintendent of Forestry.

Honolulu, T. H., Dec. 31, 1905.

Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:—I have the honor to submit herewith the Annual Report of the Division of Forestry for the year ending December 31, 1905; and to transmit certain other reports from my assistant, the Forest Nurseryman, and from a number of the District Foresters, dealing further with the subject of Forestry in the Territory.

### STAFF.

The staff of the Division of Forestry during the calendar year of 1905 has consisted of the Superintendent of Forestry, the Forest Nurseryman, and one stenographer, who has also acted as general clerk for the Board.

### APPROPRIATION.

For the fiscal year ending June 30, 1905, the lump sum of $11,780.00 was appropriated by the Legislature for the incidentals and general expenses of the Board. Of this amount the Division of Forestry was allotted $4,110.00. The appropriation for Forestry salaries and pay rolls for the same period was $5,700.00; making in all for forest work of that year a total of $9,810.00.

For the present biennial fiscal period, ending June 30, 1907, the salary roll for the two officers named above, with a small additional sum for laborers' wages, is $10,000.00, or $5,000.00 per annum. The salary of the clerk and stenographer is provided for separately, under the Board.

Of the appropriations for the general expenses of the Board and its Divisions, in all $30,098.00, the allotment of the Division

of Forestry for the biennial period is $8,900.00, or $4,450.00 per annum. The additional sum of $1,200.00 per annum, for the collection and propagation of seeds and plants, is also ex pended through this Division, thus making the total available fund of the Division of Forestry for the present fiscal period $10,650.00 per annum.

This statement may be made in tabular form as follows:

| | Per Annum. | Per Period. |
|---|---|---|
| Salaries and Pay Rolls | $ 5,000 | $10,000 |
| General Expenses (allotment) | 4,450 | 8,900 |
| Total | $ 9,450 | $18,900 |
| Seeds and Plants | 1,200 | 2,400 |
| Total Available Fund | $10,650 | $21,300 |

Further details in regard to the Board's appropriation may be found elsewhere in this volume.

CONTENTS OF THIS REPORT.

The work of the Division of Forestry falls naturally under one or another of several general heads. In this report it will be considered under the following divisions: Forest Reserves, Forest Extension, Miscellaneous and Routine Work, Forest Fires, General Forest Work in the Territory, and Plans and Recommendations for the Future.

## FOREST RESERVES.

The main efforts of the Division of Forestry since its organization have been directed toward the creation of forest reserves, because it is believed that this is the forest work of most importance to the Territory at the present time. The necessity of maintaining a permanent forest cover on the important watersheds throughout the islands is too well understood to require discussion here. It is enough to say that success in agriculture in most parts of the Territory depends on an ample supply of water. The essential objects of the forest reserves are to protect the forests and through the introduction of a rational system of forest management to enable them to better serve the purpose of conserving moisture.

In consequence of the limited appropriation available, other branches of the work of the Division of Forestry have of necessity had to take second place, although as will be pointed out later, as much attention as was possible under the circumstances has been given to them.

The procedure of making forest reserves in Hawaii and the relation between the total area within the reserve boundaries and the area actually set apart may be thus described.

Following an examination on the ground, the Superintendent of Forestry recommends to the Board of Commissioners of Agriculture and Forestry the reservation of the area which in his judgment should, for the best interests of all concerned, be kept permanently in forest. If the Board approves this report it adopts a resolution favoring the reserve. A public hearing is then held by the Governor and the Board for an expression of opinion. If no opposition develops, the Governor by proclamation recommends the reservation of the area suggested by the Superintendent of Forestry and actually sets apart such government lands within the boundaries of the reserve as are not under lease, or on which the leases are within two years of expiration. Thereafter the other government lands within the reserve are set apart as their leases expire. The individuals and corporations owning or controlling land within the reserve are asked to coöperate with the Board, under the law, that by the adoption of an organic system of forest management, the objects for which the reserve is created may be attained. Except as the owners coöperate with it, the Board can exercise no jurisdiction over the private lands within the reserve.

## RESERVES ESTABLISHED.

At the beginning of 1905 two forest reserves had been set apart: the upper portion of the land of Kaipapau, District of Koolauloa, Island of Oahu, 913 acres; and the Hamakua-Pali Forest Reserve, District of Hamakua, Island of Hawaii, 18,940 acres.

During the year three more forest reserves have been created, embracing a total of 190,469 acres, of which 38,844 acres of government land have been actually set apart.

The following table shows the name, location, area and date of creation of the existing forest reserves:

FOREST RESERVES.

| No. | Name | District | Island | Area Government Land Actually Reserved | Total Area Recommended to be reserved | Date of Proclamation | Proclamations Signed by |
|---|---|---|---|---|---|---|---|
| | | | | Acres | Acres | | |
| 1 | Kaipapau | Koolauloa | Oahu | 913 | 913 | Nov. 10, 1904 | Geo. R. Carter |
| 2 | Hamakua Pali | Hamakua | Hawaii | 17,000 | 18,940 | Dec. 23, 1904 | Geo. R. Carter |
| 3 | Hilo | Hilo | Hawaii | 12,771 | 110,000 | July 24, 1905 | A. L. C. Atkinson |
| 4 | Koolau, Maui | Koolau, Hamakua-loa | Maui | 15,083 | 42,969 | Aug. 24, 1905 | A. L. C. Atkinson |
| 5 | Halelea | Halelea | Kauai | 10,990 | 37,500 | Aug. 24, 1905 | A. L. C. Atkinson |
| | | | | 56,757 | 210,322 | | |

DURING THE SPRING OF 1906, WHILE THIS REPORT WAS IN PREPARATION, TWO ADDITIONAL FOREST RESERVES WERE SET APART, AS FOLLOWS:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6 | Kealia | Puna | Kauai | 7,385 | 9,935 | Mar. 9, 1906 | A. L. C. Atkinson |
| 7 | Ewa | Ewa, Waianae and Waialua | Oahu | 4,759 | 28,550 | Mar. 9, 1906 | A. L. C. Atkinson |
| | | | | 68,901 | 248,807 | | |

*Hilo Forest Reserve.*

The Hilo Forest Reserve embraces the area of heavy forest on the lower slopes of Mauna Kea, lying between the 1855 and 1881 Lava Flows back of Hilo Town and the Hamakua District line, and extending from a line varying in elevation from 1,750 to over 2,000 feet, drawn back of and above the sugar plantations to another line along the upper edge of the woods, at an elevation of approximately 6,000 feet. The water from this reserve is of great importance to all the plantations along the coast, being at present used for the most part for fluming cane to the mill. From the character of the country many of the streams could be utilized for the production of power. This will be an important consideration when the Hilo District comes to be developed, as it is sometime bound to be. The object of the Hilo Forest Reserve is to protect the sources of this important water supply.

*Koolau (Maui) Forest Reserve.*

The Koolau Forest Reserve on Maui, takes in the greater part of the watershed on the windward side of that island, the area from which comes the water for irrigating the central plain lying between the two Maui mountains. Hardly anywhere outside of Southern California is there a more striking object lesson of the benefits of irrigation than that afforded by this section, much of which has been transformed, through the application of water, into some of the most productive cane fields in the Territory. The area included in the Koolau Reserve extends from the land of Opana to the boundary of the Hana District, and from the line of the new Koolau Ditch and its extension to the northern crest of the crater of Mt. Haleakala.

*Halelea Forest Reserve.*

The Halelea Forest Reserve on Kauai, includes an area of mountainous land, much of which is naturally protected because of its situation and topography. The main economic value of the section comes from the fact that the streams rising in the Reserve may be used to develop power and possibly, in

part, for irrigation. The Reserve includes all the higher portion of the Halelea District, above a line drawn parallel to the coast, at the upper limit of the agricultural and good grazing land.

*Detailed Reports on the Reserves.*

It is the usage of the Board to publish in full in its official organ, the Hawaiian Forester and Agriculturist, the reports of the Superintendent of Forestry and of the Committee on Forestry, with the resolutions adopted by the Board, in regard to each forest reserve recommended. The reports on the Hilo Reserve may be found in the issues of October and November, 1904; those on the Koolau and Halelea Reserves in that of August, 1905.

*Co-operation with Private Owners.*

The law creating the Board provides for the management by the Board of privately owned forest land, but owing to the fact that no money was appropriated for the employment of forest rangers, the lack of an established system of reserve administration has in large measure deterred private owners from cooperating with the Board in this matter. This is only natural, for without men the Board cannot hope to give as efficient protection as the forests in many cases now receive.

Furthermore, under the law as it now stands, only government land that is unleased, or on which the lease has less than two years to run, can be set apart by the Governor as a forest reserve. The law would be better if it permitted the Governor to set apart all government land within the reserve boundaries, subject, of course, to existing leases. The reason for this statement is that if the owners or lessees of adjoining forest land knew just what the intentions of the government were regarding the government lands within the reserve, they would be much more ready than they now are to coöperate with the Board in putting into force an organic system of forest reserve administration.

The present situation is most unsatisfactory and calls for united and determined remedial action, for without unity of

purpose in the management of the lands of a given forest reserve it is impossible to secure the most efficient protection. And unless there is a regular paid staff to carry them out, plans for the development and betterment of the forest are of little avail.

As a temporary expedient, arrangements have been made in several cases whereby employees of a plantation or other company interested in the welfare of a certain reserve act as forest rangers. But such an arrangement, although it yields good results for the time being, is neither permanent nor truly satisfactory.

One of the most encouraging signs in the whole matter is the action about to be taken by the firm of Alexander & Baldwin, whereby the management of the lands owned or controlled by them within the Koolau Forest Reserve on Maui, is to be turned over to the Board. It was hoped that this report might record the consummation of this transfer and give the details of the coöperative arrangement, but although practically completed the final papers had not been signed on December 31st.

The arrangement with Alexander & Baldwin is based on the assumption that the Board will shortly be in a position to put into effect an efficient system of forest reserve administration. Until then the present plan of control through rangers jointly employed will be continued.

Mr. A. S. Wilcox has signified his intention of following the lead of Alexander & Baldwin in this matter, in regard to certain lands belonging to him in the Halelea Reserve on Kauai, and it is expected that others will do likewise.

The fact that such action has been or is to be taken by prominent firms and individuals will, it is believed, act as a strong lever when pressure is brought to bear to secure an appropriation for forest rangers from the next Legislature. It is with the firm conviction that money for the employment of forest rangers will be forthcoming when the needs of the situation are really understood, that the work of creating new reserves is being steadily pushed. But to secure the ends desired the active and earnest support is needed of all those whose in-

terests are involved or who wish to see the best use made of the Hawaiian forests.

*Change in the Law.*

Mention may be made here of an amendment to the forest reserve law (Chapter 28, Revised Laws) by Act 65 of the Session Laws of 1905, which provides that the Governor may, from time to time, with the approval of the Commissioner of Public Lands, after a hearing or hearings, as by law provided, revoke, modify or suspend any and all the orders and proclamations or any part thereof, which set apart lands as forest reservations.

This law was passed at the instance of the Commissioner of Public Lands, with the object of providing a less cumbrous procedure than formerly existed, by which forest reserve boundaries could be modified. The new law is an improvement on the original, but it would be better had the consent of the Board of Agriculture and Forestry as well as of the Commissioner of Public Lands been required before changes in a reserve could be made.

RESERVES UNDER WAY.

The nature of the work of establishing forest reserves is such that the table of existing reserves at any one time is a poor index of the work actually accomplished up to that date. Much preliminary detail has to be gone through with, both in the field and in the office, before a report recommending the creation of a given reserve can be made by the Superintendent of Forestry. Then the regular routine action by the Committee on Forestry and by the Board, followed after an interval of at least a fortnight by the Public Hearing, takes perhaps another month, so that between the initial field work and the day when the proclamation is signed by the Governor, a considerable period of time must necessarily intervene. It frequently happens, too, that various outside details have to be arranged which still further delays the regular order. A case in point is the proposed Kealia Forest Reserve on Kauai, where the initial field work was done in May, 1904; the report on this reserve went to the Committee on Forestry on December 30th,

1905. The report on another important project, the proposed Ewa Forest Reserve on Oahu, will be completed during the first fortnight of January, 1906, and will probably be put through with or shortly after the Kealia Reserve.

*The Proposed Kealia Forest Reserve.*

The proposed Kealia Forest Reserve includes the higher portion of the north end of the Puna District on Kauai, embracing the three government lands of Anahola, Kamalomaloo and Kapaa, and the privately owned land of Kealia. Altogether it covers an area of 9,935 acres, of which 7,385 acres is government land which can be set apart at once.

*The Proposed Ewa Forest Reserve.*

This reserve takes in a good share of the western slope of the Koolau Mountain draining into the Ewa Basin, on the Island of Oahu. It covers in all 28,550 acres more or less, of which the greater part is privately owned land. The area belonging to the Territory within the reserve is 5,142 acres; of this 4,759 acres can be set apart at once.

*Other Proposed Reserves.*

Kau Forest Reserve.

The proposed Kau Forest Reserve takes in a large section of the native forest on the lower slope of Mauna Loa, back of the Pahala and Hutchinson Plantations. Much of the area has been protected from cattle for a number of years by these plantation companies, and maintained by them as a private forest reserve. This project will be reported upon as soon as a description of the boundary is received from the Government Surveyor, who is now at work on the ground.

Honuaula Forest Reserve.

A small but important reserve is about to be made on a portion of the land of Honuaula, North Kona, Hawaii. This land contains one of the best stands of Koa (*Acacia koa.*) on any government land in the Territory, which in view of the grow-

ing market for Koa lumber is of no small potential value. The land was leased by the last administration for grazing purposes, but by an arrangement with the lessees, effected through the courtesy of the Commissioner of Public Lands, the forested portion has been relinquished to the Board. A relocation of the boundary is to be made by one of the Government Surveyors during January, 1906, following which the land will be set apart, as the Honuaula Forest Reserve. The area is between 600 and 700 acres.

### Kohala and Hamakua.

Preliminary field investigations have already been made on the Kohala Mountain and in a part of the Hamakua District on Hawaii, which will facilitate final action when certain other factors in the case are favorable. In North Kohala a careful examination has been made on the ground so that no further field work is necessary for the present in that section.

The necessity of forest preservation in North Kohala is perhaps more pronounced than anywhere else in the Territory, but owing to complications of private ownership and leasehold the problem is a very difficult one to solve.

### Other Examinations Already Made.

Preliminary examinations have been made on the West Maui Mountain and in the Hana District on Maui, in both of which localities forest reserves are projected. The West Maui Districts are next on the regular program of reserve work.

On Oahu an extension of the Ewa Reserve in the Waialua Basin, and an area on the Waianae Hills only await technical descriptions of the proposed boundaries before being reported upon, and these have been promised in both cases by private corporations interested in the creation of these reserves. Another section of the proposed forest reserve on the Waianae Range, including parts of the lands of Makua and Keaau, is still further advanced, a report upon it having already been approved by the Board, while a report on the land of Lualualei is now in preparation.

On Kauai preliminary field work has been done on two

areas which it is expected will later be created forest reserves; these are the upper part of the Koolau District and the section including the private reserve maintained by the Lihue Plantation Company, adjoining the proposed Kealia Reserve.

*Forest Lines.*

Mention may here be made of several requests that have been received from the Commissioner of Public Lands in relation to fixing the forest line on lands to be again leased or to be opened as homesteads. This work has often been made a part of studies leading to the creation of projected forest reserves, but it has also included some special examinations in sections which were not to be taken up until later. Reports on the location of the forest line have been submitted for the lands of Kaohe 4, Opihihale, and the Olaa Remnant on Hawaii, for the land of Nakula on Maui, and for the Palolo Homestead Tract and the lands of Makua and Keaau on Oahu.

RESERVES PROJECTED.

Among the forest reserve projects which have yet to be undertaken, beside those already mentioned as being now under way, are the following:

On Kauai, a portion of the great upland area on the land of Waimea should be made a forest reserve. It is expected that an examination of this area will be made during the coming summer.

On Oahu, portions of the Waianae Range, not covered by reserves already mentioned, need attention, as does also the area between the existing Kaipapau and the proposed Waialua Reserve. Sections on the windward side of Oahu also wait to be visited and reported upon.

On Molokai nothing has as yet been done by the Government toward officially recognizing the existing private forest reserves or extending their boundaries, while in the Districts of Kula, Honuaula and Kahikinui, on Maui, there are problems of forest replacement waiting to be solved.

Hawaii, beyond the areas already discussed, is perhaps in less need of immediate attention, but there are still many localities on that island that should be investigated and reported on, as for example, the mountain land of Kaohe and certain government tracts in South Kona.

The pressing need on Hawaii is that something be done and done at once to better protect the forest in Kohala and Hamakua. Unless such action is taken within the very near future the forest will disappear from large areas of land which should be kept permanently under a forest cover. If this happens the forest can only be replaced after great labor and expense.

*Additions to Existing Reserves.*

From time to time as the leases on forest lands within the boundaries of one or another of the existing forest reserves come within two years of the date of expiration, the attention of the Governor will be drawn to the matter, with the request from the Board that he set apart the given land as an addition to the Reserve. In the near future several areas will, in this way, be added to the Hilo Forest Reserve, while later other reserves will receive similar accessions.

*Reserve Boundary Monuments.*

Realizing the importance of having the principal points along the forest reserve boundaries plainly marked with permanent monuments, particularly certain corners and other points that have been located with care and expense, forest reserve monuments have been made consisting of two 4½ foot sections of galvanized iron pipe, the upper section carrying a target, also of galvanized iron, stamped with the letters F. R. T. H. (Forest Reserve, Territory of Hawaii).

There are two types of the monument. In one the two sections screw together by means of a threaded collar; in the other, the upper pipe fits over the lower, so that it can be easily removed if it is desired to set up an instrument on the station, the upper pipe being held in place by a bolt, secured by a railway switch padlock. The former is used at points

in the woods not likely to be needed in relocation; the latter at stations which may often be needed for reference in other survey work. No monuments were erected during 1905, but orders have been given for marking several lines early in 1906.

*Co-operation of the Government Surveyor.*

In this connection I wish to express my appreciation of the coöperation of Mr. W. E. Wall, Government Surveyor, in many matters regarding the boundary lines of proposed forest reserves. His uniform courtesy in furnishing the desired descriptions and other information has added materially to the success of the work of this Division.

## FOREST EXTENSION.

The second main branch of the work of the Division of Forestry is the extension of a forest cover over waste and barren areas or other land which can more profitably be used to produce trees than some other crop. Under this section comes, of course, the establishment of forest plantations made with the object and idea of commercial returns. Next to the creation of forest reserves this is believed to be the most important forest work at present to be done in the Territory.

Forest Extension in Hawaii is carried on through two channels: (1) by advice and practical assistance given in the form of planting and working plans, correspondence or verbal direction to individuals or corporations desiring to engage in any class of forest work, and (2) by the collection, sale and distribution of seed and seedling plants of native and introduced trees and shrubs of value for use in the islands.

### ADVICE AND ASSISTANCE.

Following the usage of the United States Forest Service, the Division of Forestry has stood ready, at all times since its organization, so far as its resources permitted, to answer by practical advice, all questions in regard to tree planting, forest management or other germane forest subjects referred to it. The offer has been made and repeated both verbally and in print and during the last year has led to a considerable

number of requests, the inquiries for the most part having to do with tree planting. But although more likely to be called upon for advice in starting forest plantations the Division is prepared to suggest methods of management for plantations already established, or to make working plans for the systematic cutting of stands of trees which have reached merchantable size or greatest economic value.

Unfortunately, few of the native Hawaiian trees are of commercial importance, so that working plans for the utilization of the native forest are not often called for. But where a market does exist, as for Koa, the Division of Forestry is ready to assist the owner to do his logging in accordance with the methods of practical forestry.

In this connection it may be noted that after a study of the situation made on the ground in December, 1904, the Superintendent of Forestry prepared a statement with recommendations for the Trustees of the Bishop Estate, in regard to the lumbering of the Koa on the land of Keauhou, Kau, Hawaii. While not all of the recommendations made in the report were adopted, the general plan outlined therein was embodied in a contract made with a company formed to undertake the lumbering. Up to the end of 1905 actual work in the woods had not begun, but many preliminary details have been settled so that the early months of the coming year should see the work fairly under way.

During 1906 it is expected that the preparation of planting plans will take a larger place than has been possible heretofore, owing in part to the publication in December, 1905, of Circular No. 1 of the Division of Forestry, entitled "An Offer of Practical Assistance to Tree Planters." This Circular explains what the Division of Forestry is prepared to do for individuals or corporations desiring to plant trees, and is being widely distributed throughout the Territory. The offer does not differ from that which has been held open for the past two years, but owing to the limited resources of the Division it has not until recently been deemed advisable to give it the publicity now possible. Already several requests for planting plans have been received and during 1906 it is expected that much of the time of the Forest Nurseryman will be occupied

in this branch of forest work. For details in regard to the requests for advice and assistance which have been received during 1905, the report of the Forest Nurseryman should be consulted.

Another publication of the Division of Forestry which should be mentioned in this connection is Press Bulletin No. 2, entitled "Suggestions in Regard to the Arbor Day Tree Planting Contest," issued in October, 1905. This press bulletin contains careful directions of how the trees to be planted on Arbor Day on school grounds and elsewhere should be set out to insure the best results. A description of the observance of Arbor Day appears later in this report.

## COLLECTION, SALE AND DISTRIBUTION OF SEED.

The collection and dissemination of seed of trees and shrubs carried on by the Division of Forestry, is effected through the Government Nursery at Honolulu. Since May, 1904, the Nursery has been conducted on a forest basis and except for ornamental plants grown for use on school and other public grounds, the stock carried has been limited strictly to trees and shrubs of economic importance, other than fruit-bearing species.

The plan now followed is to keep constantly on hand fresh seed of the native and introduced trees, which have been found to be of value in the Territory, the seed being sold at prices just covering the cost of collection or import. A limited number of seedlings is also kept on hand and sold at prices just covering the cost of growing. These young trees are intended for persons who desire a comparatively few trees each, too small a number to make it worth their while to grow the trees themselves. In all extensive planting the recommendation is always made that a local nursery be established to supply the stock needed. The report of the Forest Nurseryman contains a detailed statement as to the kinds and amount of seed collected and sold during 1905.

To facilitate the handling of this branch of the work a press bulletin (No. 1 of the Division of Forestry) was issued in April, 1905, giving a list of the seed on sale, with the price and approximate number of seed per ounce. The latter data

were included because of the general lack of knowledge regarding the size of the seed of certain trees, especially among the Eucalypts. A revised edition of the seed list, with additions, will be issued early in 1906.

Beside keeping seed and plants on hand, the Division of Forestry stands ready at all times to advise persons so desiring in regard to the purchase of exotic trees, plants or seeds which it is not advisable or possible to carry in stock.

To this end a collection of catalogues of leading nurserymen and seed houses throughout the world is maintained. The file is already sufficiently comprehensive to meet most demands, but is being continually added to by later editions and the publications of additional firms.

Since the discontinuance of the general free distribution at the Government Nursery, several local firms have begun to deal in special lines of fruit and ornamental stock. The Division keeps informed as to the specialties handled by the local nurseries, so that persons making inquiries about such stock can be referred to them.

The Division is also prepared to recommend one or two men who have been trained in the proper methods, to persons desiring to prune their trees in accordance with rules based on the principles of tree growth.

*Free Distribution.*

Although general free distribution has been discontinued, plants and seed are furnished free to schools and other public grounds, other than the Honolulu Parks.

Forest trees in small lots are also given without charge, provided the freight is paid, to homesteaders who desire, or whose leases require them, to plant trees. Much of the success of the Arbor Day celebration was due to the trees sent out from the Government Nursery. Of late some trees have also been furnished free for the street planting resulting from the city improvement spirit which is now making such happy progress in Honolulu.

GROUNDS OF THE GOVERNMENT NURSERY.

*Congressional Vegetable Seed.*

Although properly apart from the regular work of the Division of Forestry, mention may perhaps be made here of the distribution of the free vegetable seed, furnished by the Delegate to Congress, Hon. J. K. Kalanianaole. At the suggestion of the Superintendent of Forestry, the Delegate turned his quota of seed over to this Division for distribution in both 1904 and 1905. In 1904 the seed was sent out in response to requests received in answer to notices in the newspapers.

The 1905 seed, received in November, has, by arrangement with the Superintendent of Public Instruction, been distributed through the schools, each Principal who responded to a circular letter prepared by the Board of Education being sent sufficient seed to give a package of each kind to every family represented in the school.

It is probable that the Hawaii quota of seed for 1905 has been distributed in as equable and general a manner as any seed ever sent out by a Congressman. It is a case where a bad system has been turned to good use.

*Rubber.*

The interest in rubber has led to many inquiries as to the best kinds to plant, the supply of seed, etc. Through an arrangement with Mr. Jared G. Smith, a number of persons have been referred to him by this Division and furnished with seed imported by him at a price, including the customs duty, much lower than that at which an ordinary individual in the islands could hope to obtain it.

In accordance with the provisions of the law making appropriations for the present fiscal period, plans have been made "to experiment with rubber trees on government lands," which will be put into effect during the coming year.

Through the courtesy of Mr. S. M. Damon, the Division of Forestry has secured the right to establish an experimental plot for the study and propagation of rubber trees in the Huluamanu Valley, at Moanalua, about a mile and a half above the polo field. The trees set out there are some two dozen of the Central American species *(Castilloa elastica)* secured

from Mexico some little time ago by Prof. A. Koebele. This species is hard to procure owing to the seed retaining its vitality but a short time. The trees at Moanalua will be grown, propagated by cuttings and later distributed under suitable provisions. The trees were planted at Moanalua because the conditions there are better adapted for rapid and vigorous growth than in any other locality easily accessible from Honolulu.

## OTHER WORK AT THE NURSERY.

Besides the growing of seedlings, the Government Nursery serves other ends of value to the people of the Territory. Chief among these is the experimental work carried on to determine the value to the Territory of trees and shrubs heretofore untried, or only imperfectly known here.

By exchange and purchase exotic seed is from time to time received and having been tested at the Nursery, is sent to correspondents on the different islands, or started in the Nursery, when the young plants are later sent out. The names of the more important exchanges of the Division and of the gentlemen in the Territory who have volunteered to assist in this work may be found in the report of the Forest Nurseryman. The introduction of valuable new trees and plants is a very important field of work, capable of almost infinite expansion. In later years it is hoped that it may be made one of the chief lines of activity in the Division.

### *Seed Testing.*

Allied both with the experimental and the seed introduction work is the testing of seed collected locally or received from abroad. Germination tests are made of all seed before it is sent out from the Nursery, which insures its freshness and purity, a matter of no small importance to local planters.

To facilitate the seed testing a specially constructed, glass-roofed, ant-proof house, with adjustable canvas curtains, was erected early in the year, in which the seed testing and experimental work can be carried on under conditions heretofore impossible. The protection afforded by this house has greatly

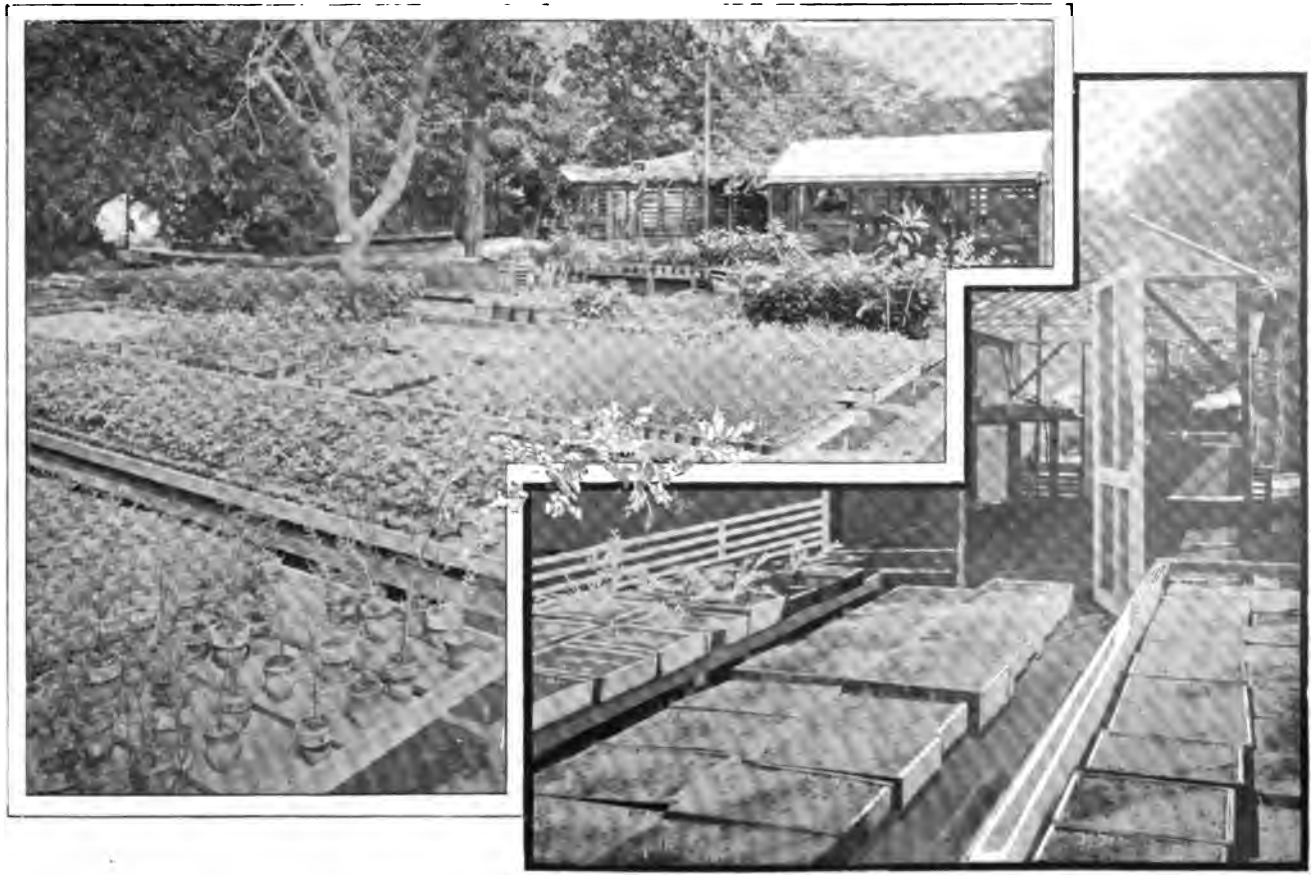

FIG. 1.—FOREST AND ORNAMENTAL TREE SEEDLINGS FOR SALE AND DISTRIBUTION. FIG. 2.—SEED TESTING HOUSE USED FOR EXPERIMENTS AND GERMINATION TESTS.

VIEWS IN THE NURSERY GROUNDS.

reduced the percentage of seedlings killed by the "damping off fungus," which had before been a source of serious loss, particularly with small lots of rare imported seeds.

*Nursery Grounds.*

Early in the year small wooden markers were placed beside the trees in the Nursery grounds, each one bearing the common and scientific name of the tree. As the Nursery in a way takes the place of a botanic garden—a feature by the way, which Honolulu should not be longer without—these labels have been much appreciated by visitors desiring to learn the local tree names.

During the past year the Nursery grounds have been brought into presentable condition. More remains to be done, but the Nursery as it now stands is a great improvement over what it was two years ago.

Closely connected with the work at the Nursery is the care of the forest plantations in upper Nuuanu Valley and on Tantalus.

NUUANU VALLEY.

During the year the forest plantations in Nuuanu Valley have been kept in shape by two laborers regularly employed who are stationed at the Forester's cottage, a mile or so below the Pali.

No new planting has been undertaken, but the grass and weeds around the young trees have been kept down and general care taken of the forest plantations established in past years.

A noticeable change has taken place within the last year in the appearance of the planted forest in Nuuanu. Many of the saplings are now getting up where they can be seen above the long grass, and in general the trees appear much more thrifty than they did a year ago. During 1906 the work in Nuuanu Valley will be continued along the same lines.

TANTALUS.

Although Tantalus forest is not directly under the control of the Board of Agriculture and Forestry it has, by direction

of the Superintendent of Public Works, been turned over to this Division for management. There is much which ought to be done on the government portion, in the way of thinnings, etc., but owing to the fact that little of the government timber to be so obtained is readily salable, and to the lack of sufficient appropriation, little can at present be attempted. Some dead wood has been removed by a Portuguese woodcutter working under the direction of the Forest Nurseryman, while several of the old trails have been cut out and made passable.

This latter work is important as an aid in fighting forest fire should that misfortune ever happen to the Tantalus forest.

With the clearing of the trails a number of groups of valuable exotic trees have been made accessible and the obstructing vegetation cut away to give them a fair chance.

Early in the year steps were taken looking to the acquisition by the Territory of the portion of the Tantalus forest belonging to the Coney Estate, but as yet nothing tangible has come of it. The matter should be taken up and put through, for under the present status there is nothing to prevent the clean cutting of a large part of the Tantalus forest at any time. A bill to create the upper part of Tantalus a public park was introduced at the last session of the Legislature but failed to pass.

## MISCELLANEOUS AND ROUTINE WORK.

Beside its regular and more important work the Division of Forestry endeavors, so far as its appropriation allows, to carry on other lines of forest work of value to the Territory. Chief among these are the collections. These consist of the herbarium, the exhibit of Hawaiian woods, a series of photographs illustrating Hawaiian forests and forest conditions, systematic notes on the trees and forests of the islands, and the collection of maps of forest and other lands, not to mention the accessions of forestry books to the Board Library. Lack of means and a staff of only two men has hindered the growth of the collections, but a start has been made on each.

During the coming year the maps will be classified and properly housed in a new map case and the collection indexed

by a card catalog. A card catalog of the forest lands in the Territory is also projected, giving the name, location, ownership, date and terms of existing lease, if government land, and other similar information. Such a catalog would be of great assistance to the staff, especially in keeping track of lands to be added to existing reserves.

In the gathering of botanical notes that has gone on during the year, special attention has been paid to the preparation of a table showing with exactness the times of flowering and of fruiting of the important forest, ornamental, and fruit trees in and about Honolulu.

Mention may perhaps be made here of the shipment to the U. S. Forest Service of sections of the logs from which were prepared the specimens of Hawaiian woods in the exhibit room of the Board, a slight recognition of the many favors received from that Bureau.

## ROUTINE WORK.

During the year reports covering the work of the Division have been prepared by the Superintendent of Forestry and submitted at each regular meeting of the Board, while the Forest Nurseryman has filed weekly reports describing the work under his immediate charge.

Special reports on the progress of forestry in the Territory have by request been prepared by the Superintendent of Forestry for the annual report of the Governor of the Territory to the Secretary of the Interior, for delivery at the annual meeting of the Hawaiian Sugar Planters' Association and before the Farmers' Institute. He has also contributed articles on forest subjects to the Hawaiian Forester and Agriculturist, to Thrum's Annual and to the daily press.

## PUBLICATIONS.

The publications of the Division of Forestry issued during the year are as follows:

Press Bulletin No. 1. A list entitled "Forest and Ornamental Tree Seed for Sale at Government Nursery." 3 pp. Issued April, 1905. (1000 copies.)

Press Bulletin No. 2. "Suggestions in Regard to the Arbor Day Tree Planting Contest." 7 pp. Issued October, 1905. (750 copies.)

Circular No. 1. "An Offer of Practical Assistance to Tree Planters." 6 pp. Issued December, 1905. (2,000 copies.)

Two circulars are now in preparation on "The Proper Methods of Pruning Street Trees" and on "Suggestions for Fighting Forest Fires," and as a press bulletin, a revised list of the seed on sale at the Government Nursery. Other circulars are projected, especially one on the "Culture and Uses of the Cocoanut," and it is hoped that during the year one or more bulletins may be prepared on the results of forest plantations made in these islands within the past thirty years.

The routine office work has been further systematized during the year by the addition of needed units in the filing cabinets, the extension of the card system and other like mechanical aids.

## DISTRICT FORESTERS.

During the year several changes have taken place in the personnel of the staff of District Foresters through death, removal from the Territory and by appointment. In the death of Mr. Franz Buchholtz, who passed away February 16, 1905, the Territory sustained a real loss, for men of his type are much needed in a community like ours.

Owing to removal from the Territory, resignations have been received from Messrs. George Ross of Hakalau, Hawaii, E. E. Olding of Kohala, Hawaii, and Andrew Moore of Kilauea, Kauai.

The new appointments are Mr. John M. Ross, to succeed Mr. George Ross; Mr. F. Scott, to succeed Mr. Moore; and Mr. Eric H. Edwards, to take Mr. Buchholtz's place. On December 31, 1905, no one had been appointed to succeed Mr. Olding.

Additional District Foresters have been appointed as follows:

Mr. W. F. Pogue, for the District of Koolau and the east half of the District of Hamakualoa, Island of Maui.

Mr. John A. Scott, for that portion of the District of Hilo,

Island of Hawaii, extending from the Puna District Line to and including the land of Kikala.

Mr. George W. McDougall, co-forester with Mr. W. R. Castle of Honolulu, for that portion of the District of Kona, Island of Hawaii, extending from the land of Kaapuna to and including the land of Hookena.

Mr. Charles Gay, in and for the island of Lanai.

A change in the forest district boundaries has been made on Maui, whereby Mr. Pogue now covers part of the area formerly in the district of Mr. H. A. Baldwin.

A list of the District Foresters, with their respective districts, may be found elsewhere in this report.

## FOREST FIRES.

The early months of 1905 witnessed a prolonged drought in the islands which led to a number of serious forest fires, especially on the leeward side of the islands of Hawaii and Oahu.

### SOUTH KONA FIRES.

The fires in South Kona, Hawaii, and the one at Wahiawa, Oahu, were the most serious. The former started on February 22, 1905, and was first reported to Land Commissioner Pratt a day later. As the result of a rapid interchange of wireless messages the Governor and the Board authorized the Superintendent of Forestry to go over to Kona, which he did on February 25 on the U. S. Revenue Cutter *Bear*, through the courtesy of Captain Hamlet, who chanced to be just starting on a cruise to Hawaii.

On arriving in Kona a fire fighting gang was at once organized under the direction of Mr. G. W. McDougall, and the work of getting the fire under control begun. The land where the fire occurred is covered with rough a-a lava, out of which grew a fairly dense Ohia Lehua *(Metrosideros polymorpha)* forest. Over much of the area the undergrowth was Uluhi or Staghorn fern *(Freycenetia arnoti)*, which when dry is extremely inflamable. The fire was for the most part a surface fire, confined to the Uluhi, although it constantly tended to become

a ground fire in type, by hanging in the dry vegetable matter in the openings in the lava.

Having had a start of a week the fire had already burned over a considerable area, before the fighting began; consequently the work was at first confined to widening two old trails on either side of the fire into fire lines to prevent the fire from spreading and to give bases from which to work. After several days, welcome rains so far subdued the fire that it was got under control and apparently extinguished. Leaving guards to patrol the area the Superintendent of Forestry returned to Honolulu, only to hear some six days later that the fire had again broken out, apparently from some point where it had been smouldering in the crevaces in the rocks.

Mr. McDougall was authorized to continue the fight which he did by surrounding the new fire by fire lines and gradually stamping it out. After about a fortnight he reported that heavy rains had completely extinguished the fire.

The forest on the area burned over consisted mainly of Ohia Lehua trees 6 to 10 inches in diameter breasthigh and from 30 to 50 feet tall. Being a thin barked tree most of the Ohias were killed by the fire, although few were actually consumed. The loss is hard to reckon because while at present only marketable as firewood, the type of Ohia growing in South Kona has a potential value which in the future may make it of considerable worth. The total area burned over is estimated at 2500 acres.

The origin of the South Kona fire is unknown. Certain signs point to its having been set to secure more open pasturage; others to its escape from a wood cutters' camp. No reliable evidence could be secured in either case.

*Special Appropriation.*

At the instance of Governor Carter, a bill providing for an emergency appropriation of $2,000.00 was introduced in the Legislature and speedily passed. The cost of the South Kona fire was, all told, a little over $2,200.00. The remainder, above $2,000.00, was paid out of the regular appropriation of the Board of Agriculture and Forestry.

## NORTH KONA FIRES.

The fires on the Bishop Estate lands in North Kona, also in February, were attacked as soon as discovered and while stubborn, were checked before much damage was done. Mr. T. C. White was in charge of this work, while Mr. F. S. Dodge, the Superintendent of the Bishop Estate, was also on the ground, remaining until the fires were under full control.

## WAIANAE UKA FIRE.

The Waianae-uka fire on Oahu originated from a grass fire started by one of the Wahiawa colonists. Getting beyond contol it spread rapidly to the adjoining forest where it required the services of some five hundred men, before it was put out. Special credit belongs to the Waialua Agricultural Company which sent gangs of laborers to the fire and kept them at work until it was extinguished. The fire fighting at this fire, which occurred in March, was in charge of Mr. David Haughs, Forest Nurseryman of the Division of Forestry.

For details in regard to other forest fires during the year the reports of the Forestry Nurseryman and of the District Foresters should be consulted.

## FOREST FIRE LAW.

One result of the forest fires of 1905 was that a forest fire bill was introduced in the Legislature soon after the return of the Superintendent of Forestry from Hawaii, modelled upon and closely following that prepared by the U. S. Forest Service for California. This bill became law with one or two slight changes and now stands on the books as Act 71 of the Session Laws of 1905. A bill to provide a fund of $5,000.00 per annum, to be used only in case of emergency, was introduced but failed to pass. Consequently there is at present no money available with which to carry out the provisions of Act 71.

It is believed, however, that much was accomplished by getting enacted a forest fire law providing for a fire fighting organization and establishing penalties for the careless or malicious starting of forest fires.

### FIRE WARDENS.

Acting under the theory that the best way to fight forest fires is to prevent them, the Board has appointed district fire wardens throughout the Territory, who have agreed to see that the law is enforced and who will take active steps when necessary to suppress fire. Being in most cases plantation or ranch managers, the fire wardens are in a position to call out a force of men without delay, and as it is usually to their personal interest to stop fires at once, speedy action in most cases is assured. The present condition is, however, far from satisfactory and some arrangement should, as soon as possible, be made to provide a fund for the payment of fire fighters. In no other way can a really efficient organization be built up.

A list of the Fire Wardens appointed under the law, with their respective districts appears elsewhere in this report.

Fire warning notices in English, Hawaiian, Portuguese and Japanese have been prepared by the Chief Fire Warden and caused to be generally posted throughout the Territory. They are printed on cloth and give certain rules to be observed regarding the use of fire, with the sections of the law containing the penalties provided for allowing fires to escape. In general make-up the notices follow those in use in Maine and New York. A copy of the English notice is given on another page of this report.

A circular is now in preparation which will contain suggestions in regard to forest fire fighting, based on methods which experience has proved to be of value elsewhere.

## GENERAL FOREST WORK IN THE TERRITORY.

### ARBOR DAY.

Outside of the work of the Division of Forestry several matters of forest interest deserve to be recorded. The one of perhaps the greatest popular interest is the inauguration of an Arbor Day celebration.

The observance of this semi-holiday was this year actually started by the action of the then Superintendent of Public

Instruction, Mr. J. C. Davis, who fixed Friday, November 3, 1905, as Arbor Day for the schools. This action awakened general interest and led the Governor to issue a proclamation officially setting apart the day and recommending its observance. Governor Carter further showed his interest in giving the first Hawaiian Arbor Day a good send-off by generously offering to contribute half of a fund to enable a prize of $5.00 to be given in each of the 154 public schools in the Territory, to the grade planting on Arbor Day the tree which as the result of being well cared for, should be in the best condition at the end of the year. The other half of the fund was raised by subscription and much interest was thereby aroused in the different schools. The trees for planting were for the most part furnished by the Government Nursery. Mention has already been made of a press bulletin of information issued at the time to assist the teachers in making the tree planting a success.

Arbor Day was generally observed throughout the Territory, both in the schools and by the general public. The interest awakened should be productive of much good.

## FOREST UTILIZATION.

### *Koa Lumbering.*

In the way of forest management it is a pleasure to record that the project of lumbering Koa on the Bishop Estate land of Keauhou is progressing favorably. Actual work in the woods has not yet begun but plans in regard to the milling and shipping of the logs are well advanced.

### *Ohia Telephone Insulator Pins.*

Another good sign is that a firm in Hilo has undertaken the systematic manufacture of telephone insulator pins from Ohia Lehua. From trials made in the islands, Ohia seems peculiarly adapted for this use. It is hoped that the industry will prove a permanent and profitable one.

*Ironwood Ties.*

Through an arrangement brought about by the Superintendent of Forestry, the Oahu Railway and Land Company secured in November, 1905, a lot of about 200 Ironwood *(Casuarina equisetifolia)* railroad ties, which will be laid in different parts of the line and tested under a variety of conditions, both with and without coatings of preservative solutions. These experiments will give valuable data and should the ties prove a success, as is expected, will lead to the establishment by the Railway of plantations of this tree.

Later when the Tantalus forest comes to be thinned, it is expected that other similar tests will be made with several of the Eucalypts and with other woods.

The Oahu Railway and Land Company is also trying experiments with various preservatives, on ties imported from the Coast.

*Black Wattle.*

A very encouraging example of a forest plantation put to commercial use is the experiment made by Mr. Jared G. Smith, in cutting the Black Wattle *(Acacia decurrens)* grove on the upper portion of the Agricultural Experiment Station grounds. The trees in this grove, which was a part of the original Tantalus forest, were mature and had begun to die. They were accordingly cut and prepared for market, careful record being kept of the amounts of wood and bark obtained. Some of the bark was sent to tanneries on the Coast, the rest sold. The results of this experiment indicate clearly that for certain situations Black Wattle is a very valuable tree, which would well repay planting. Full data in regard to the experiment are to be given in a Press Bulletin of the Hawaii Experiment Station, now in press.

*Permits for Dead Wood.*

At the request of the Commissioner of Public Lands, the Superintendent of Forestry, in March, drew up a form of permit granting the free use of limited quantities of dead wood

on government land, for fuel and other purposes. Several permits have been issued, after being first passed on by the Superintendent of Forestry, a procedure suggested by the Commissioner of Public Lands.

*Timber Theft.*

In one or two cases of theft of timber on government land the trespassers have been convicted and fined under Section 3044, Chapter 202, of the Revised Laws. It has been suggested by the Attorney General that there should be more specific legislation to cover this class of offenses.

*Forest Extension.*

A number of the Sugar Plantation companies in the Territory annually devote regular sums to the establishment and care of forest plantations. The usual amount of work has been done in 1905, but so far as is known no new forest plantations on a large scale have been undertaken.

It is understood, however, that several plantation companies have such work in mind for 1906.

*Street Tree Planting.*

In Honolulu there has been a decided movement toward city improvement during the fall of 1905, which has resulted in the establishment of numerous local improvement clubs and incidentally to more or less street tree planting, especially in the Kaimuki section. In this work the Division of Forestry has lent a helping hand, by supplying trees from the Government Nursery.

*Rubber.*

Interest in rubber has led to the establishment of several rubber plantations on the windward side of Maui, which from all accounts appear to be in a thriving and prosperous condition.

For the most part the plantations consist of the Ceara Rubber *(Manihot glaziovii)*, but arrangements are being made to plant Central American Rubber *(Castilloa elastica)* and Para Rubber *(Hevea brasiliensis)* as well.

Rubber culture is as yet in the experimental stage in Hawaii, but if present indications can be relied on, success seems assured. It is interesting to note that the beginning of the Hawaiian rubber industry dates from the sending out of Ceara Rubber seed by the Hon. J. Marsden, during his term as Commissioner of Agriculture, about twelve years ago.

## FUTURE PLANS AND RECOMMENDATIONS.

To sum up the plans for the coming year, of which mention has been made above:

As in the past two years the creation of new forest reserves will still hold first place. With the setting apart of those now pending and projected the more important forest areas in Hawaii will have been included in the chain of established reserves. The year 1906 should see most of these areas fall into line.

Next in order and importance, and really forming a part of the creation of the forest reserves, is the establishment of a proper system of forest reserve administration.

During the first year of the Division of Forestry the need for rangers was not urgent. Few reserves had then been created. But at the end of 1906 the outlook will be wholly different. Already four large and one small forest tracts have been set apart, while during the coming months it is certain that the total area of the reserves will be very largely increased. The forest reserves to be made in 1906 are fully as, if not more, important than those already established. To properly administer them so that they may be made of the greatest possible benefit to the Territory requires a force of forest rangers.

It is none too soon to begin to agitate this question, for to secure a truly efficient forest reserve service the rangers must be a paid staff under the direct and complete control of the Board. Such a system of reserve administration cannot, of

course, be put into effect until money is made available through an appropriation by the Legislature, but during the coming year a campaign of education showing the need and necessity of such action should be begun which will have its effect in the spring of 1907.

During 1906 it is the intention of the Division of Forestry to follow up its offer of Practical Assistance to Tree Planters, contained in Circular No. 1, and as far as may be to push this branch of the forest work. In the same connection it is expected that during the year one or more bulletins dealing with existing forest plantations in the Territory, will be prepared and published.

So far as the more pressing demands of the work allow, the other activities of the Division of Forestry will be continued, especial attention being paid to the gathering of notes and other data that will be of use in the subsequent work of the Division.

There is no lack of forest work to be done in Hawaii which will result in practical benefit to the Territory, and it cannot be too often said that the whole object of the forest work here, as elsewhere in the United States, is to accomplish results of practical value to all the people.

It is true that the benefits resulting from the protection of the forests on our watersheds are not as tangible as those in some other departments of governmental work, and that the money returns from forest plantations are not to be got for a number of years, but these facts should not blind one to the results which are attained in the end. The final accomplishment of certain definite and eminently practical aims is what the Division of Forestry stands for, and although the goal may not be reached for many seasons, a systematic and organic plan underlies all the work. The forest reserves are not made because they are interesting or beautiful, or because they contain certain rare trees, but because they help to make available for use the water in the streams whose drainage basins they cover. So with the planted forests. What the Division of Forestry is striving for is the best economic re-

turn for the money invested, through the production of trees of value for commercial purposes.

For the attainment of these ends it is essential that the support of an active and intelligent public sentiment be assured. The Division of Forestry will do its utmost to meet and solve the forest problems that arise. With the confidence and support of the people of the Territory it may hope to do work which will be not only of real and lasting benefit to the Territory as it is today, but which will also help in bringing in that era of greater prosperity that we believe the future has in store for Hawaii.

Very respectfully,

RALPH S. HOSMER,
Superintendent of Forestry and Chief Fire Warden.

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## Report of the Forest Nurseryman.

Honolulu, Oahu, Dec. 31. 1905.

Ralph S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu, Oahu.

Dear Sir:—I herewith submit a report of the work done at the Government Nursery, the Nuuanu Station and at Tantalus Forest, for the year ending December 31st, 1905.

### THE NURSERY.

#### COLLECTION AND DISTRIBUTION OF SEED.

Thirteen varieties of native tree seed have been collected by Mr. Robert Hind, Puuwaawaa. This seed was all from indigenous trees and has been used mostly for exchange purposes, samples having been sent to the Bureau of Forestry, Manila; Public Works Department, Guam; Mr. Newton B. Pierce, in charge Pacific Coast Laboratory and Plant Improvement Gardens, Santa Ana, Cal.; and to others.

Seed for sale and free distribution has been collected on Tantalus and around the city, and although the demand has not been so large as expected, a number of people have taken advantage of the offer of this Board to supply useful forest and ornamental tree seed at prices covering the cost of collecting and sorting.

Seed has been imported from Japan, Australia and California. A number of varieties of Eucalyptus new to the Islands have been imported from Australia and are being tried on different parts of the Islands. The Jarrah *(Eucalyptus margenata)*, which is one of the most valuable timber trees in Australia, is again being experimented with. Previous experiments with this tree were not successful, but by trying it at higher elevations on the different islands there may yet be found locations where it may be successfully grown. It has been tried in different districts at elevations from sea level up to twelve hundred feet. The object of keeping on hand fresh seed of the most valuable forest and shade trees is to encourage tree planting whether it be for forest, windbreak, shade or ornamental purposes.

Trees for use on the grounds of public institutions, such as schools, parks, etc., are supplied free of charge, as are also trees for street planting. Homesteaders who have acquired Government land and are required to plant a certain number of trees per acre are also supplied free of charge. To others the seed is offered for sale at prices just covering the expense of collecting and sorting. Press Bulletin No. 1 of this Division gives the varieties of seed kept on hand. All seed whether received from abroad or collected on the islands, is tested before it is offered for sale or given away gratis. The new testing house erected during the year has proved to be of great benefit in testing and also in experimenting with imported seed and valuable seed collected here.

The assistance of the Division is given to those who wish to import seed or plants from abroad. Current catalogues of the leading seed and nursery firms of the United States, Europe, the Australian Colonies, Japan and Ceylon are kept on file for the benefit of those who may wish to consult them.

Many inquiries have come to this office for information regarding the best kinds of rubber trees to plant, where seed can be procured, etc. About 14 lbs. of Ceara Rubber seed *(Manihot glaziovii)* was collected in and around the city and found a ready sale at twenty cents per ounce. A number of the applicants for rubber seed were referred to Mr. Jared G. Smith of the U. S. Experiment Station, who has a special rate from several firms in Europe for Ceara and other rubber seed.

*Congressional Vegetable Seed.*

During the years 1904 and 1905, a large quantity of congressional vegetable seed was received from Delegate Kalanianaole and distributed by this Division.

A notice in the daily papers that congressional vegetable seed would be sent to any one applying for same brought many applicants from all over the Islands.

*Experiments with Rubber.*

Twenty five Central American rubber trees *(Castilloa elastica)*, the seed of which was collected by Prof. Koebele while in Mexico some two years ago, are being experimented with on a piece of land in Moanalua gulch, kindly granted by the Hon. S. M. Damon. As there was no suitable land controlled by the Board for experimenting it was deemed advisable to ask Mr. Damon to let us have land in Moanalua gulch for that purpose. Our request was at once granted, and a piece of land was selected at an elevation of about 400 feet above sea level, and situated about one and a half miles above the Polo ground.

A wire fence was erected around the plot selected, and the twenty-five trees planted in rows fifteen feet apart each way. The trees were planted on November 1st and are doing exceedingly well. The object in view is to get the trees well started so that cuttings or seed may be got from them to supply the local demand and save much money to those who may be sending abroad for seed or plants.

## GROWING AND DISTRIBUTION OF PLANTS.

The object of keeping tree seedlings on hand for sale and free distribution is to supply plants that the private nurseries do not keep in stock. The selling prices of plants from this nursery just covers the cost of raising. The large majority of the plants, however, are given away free. All the schools of the Territory are on the free list, also the Improvement Clubs for street planting. Homesteaders who have acquired Government land are also given a limited number, on application.

The success of the first Arbor Day held in the Territory was largely due to the assistance given by this Division in supplying trees for that day to all the schools of the Territory and others who applied for them, free of charge. The Improvement Clubs of the city are also drawing heavily on our stock. The Waialae, Kaimuki and Palolo Improvement Club has had about three thousand trees raised at the Nursery for use on the streets of the tree districts covered by the Club. Over one thousand trees of different kinds have been given to the homesteaders in Palolo Valley to be used mostly for shelter belts. Some five hundred trees of various kinds have been sent to Guam.

At intervals of from two to three months the writer visits all the private nurseries of the city for the purpose of ascertaining the line of plants they intend keeping in stock for sale. By doing this we are able to avoid coming in competition with them and we can also give information to those who call at this nursery seeking such plants as ferns, palms, shrubs, fruit trees and vines.

*Distribution of Plants from the Government Nursery for the Year 1905.*

| | Forest. | Fruit. | Ornamental. |
|---|---|---|---|
| Given away ..... | 7500 | 100 | 3909 |
| Sold ..... | 3500 | 60 | 1090 |
| Totals ..... | 11,000 | 160 | 4999—16,159 |

The sale of plants has resulted in receipts of $124.00 and the sale of seed $107.22, which has been paid into the Treasury as a realization.

## EXPERIMENTAL WORK.

By exchange we are continually receiving seed of new and rare plants from the Forestry Department, Manila; Public Works Department, Guam; Mr. Newton B. Pierce of the Pacific Coast Laboratory, and we have lately started an exchange with the Acclimatization Society of Queensland. Through these agencies we expect to receive many valuable additions to our flora.

Samples of most of the imported tree seed have been sent to Mr. F. W. Carter of the Parker Ranch, Mr. Louis von Tempsky of the Haleakala Ranch, and Mr. Walter G. McBryde, Eleele, Kauai, and others. The above named gentlemen have taken a great deal of interest in the forestry movement and have done much valuable work.

## ADVICE AND ASSISTANCE.

Twenty requests to visit places in and around the city for the purpose of giving advice and assistance have been acted on. The nature of the advice and assistance being as follows: Moving large trees, planting and care of trees, pruning, street planting, etc.

### *Arbor Day.*

Arbor Day which took place on November 3rd, was generally observed throughout the Islands, and plants to the amount of 2846 were distributed among the schools of the Territory. The following is the number of schools by islands and the number of plants sent out for Arbor Day planting:

| Islands. | Schools. | Plants. |
|---|---|---|
| Oahu | 24 | 425 |
| Hawaii | 36 | 1590 |
| Kauai | 7 | 121 |
| Maui | 13 | 478 |

| | | |
|---|---|---|
| Molokai ..... ..... | 4 | 206 |
| Lanai ..... ..... | 1 | 26 |
| Parks, private schools, etc..... | | 708 |
| Total ..... ..... | | 3554 |

The Waialae, Kaimuki and Palolo Improvement Club held its first Arbor Day on Thanksgiving Day, Novermer 30th, when the members of the Club turned out and planted about three hundred trees on the streets covered by the Club. A large quantity of Algaroba seed was also planted on vacant lots. Considerable tree planting has been done since by the members of the Club.

## NURSERY GROUNDS.

The labelling of the trees in the Nursery grounds has been much appreciated by tourists and others visiting the Nursery, and with the use of the Library, which contains many valuable works on Botany and other subjects, many visitors have spent a very pleasant and instructive hour viewing and reading about the different trees to be found growing here.

A number of classes from the public schools of the city have visited the Nursery for botanical studies.

The old green house has been removed and a new testing and propagating house built. Other general improvements have been made, such as improving sidewalks, levelling and grassing over parts that required attention, etc. Sheriff Henry has assisted us considerably in granting the use of the prisoners to work in the Nursery. Without their help it would have been impossible to keep the grounds in good condition, owing to the limited help at our disposal.

A new herbarium cabinet has been built and put in the seed room, but I regret to say that the additions to the herbarium collection have been small. Although the botanical notes on the flowering and seeding seasons of the different plants are being kept up, my time is too much taken up with other matters to give the time and attention these subjects require.

FOREST AND BRUSH FIRES.

During the year we have had several forest and brush fires on Oahu, the most serious one being the fire in March, which started on the land of one of the Wahiawa colonists and spread into the forest of the U. S. Military Reservation. Had it not been for the timely action of Mr. W. W. Goodale, Manager of the Waialua Agricultural Co.; Mr. E. K. Bull, Manager of the Oahu Plantation; Mr. W. A. Buick of the Dowsett Ranch; Mr. B. O. Clark and others in sending men and assisting in putting the fire out it might have been very serious indeed.

The water supply for the Waialua plantation, Wahiawa Colony and, in part, the Oahu plantation, is got from this watershed, part of which was burned. At your request I was on the ground to take charge and assist in putting out this fire.

A small fire, mostly brush, was started at the top of Palolo Valley early in the year, one on the east side of Kalihi Valley in July, and one on Pacific Heights, also in July. At each of those fires members of the staff were present and assisted in putting them out. The fires did small damage, each one being put out before it had time to spread into the dense forest.

## NUUANU FOREST STATION.

Two men have been employed during the year. Their principal work being to keep in check the vine "Maile Pilau," which is a great pest in the upper part of the valley. The men also fill up the spaces around the roots of the young trees caused by the swaying of the trees during heavy winds. This is very necessary work, for leaving this space open, and allowing the air to get at the roots would be very apt to cause the death of many of the younger trees. In many cases, too, the trees themselves have to be straightened up.

The general condition of the forest has improved considerably during the last year and young trees that could scarcely be noticed above the grass, at the beginning of the year, are now from three to eight feet high and are in a healthy condition. This does not apply, however, to the wind-swept ridges close by the Pali. In such places, although planted at the commencement of the work in Nuuanu some eight years ago,

the trees are small and stunted, some of them hardly visible above the Hilo grass.

The trees in the six experimental plots, with close planting, planted during the months of March and April, 1904, are also in a healthy condition. Plots 2, 4 and 6 planted in *Eucalyptus robusta*, 3x3 ft., 4x4 ft., and 5x5 ft., respectively, have done better and grown more evenly than the alternate plots planted in *Casuarina*. The plants in the three plots mentioned have made about the same average growth and the trees are from one and a half to two inches in diameter at the butt, and from six to nine feet high. Plot No. 1 is planted in *Casuarina tenuissima*; and Nos. 3 and 5 in *Casuarina equisetifolia*; 3x3 ft., 4x4 ft., and 5x5 ft., respectively. On Plot 1 the trees are from ¾ to 1¼ inch in diameter at the butt and from three to seven feet high. Those on Plots 3 and 5 are very irregular in growth, the majority of the trees not being over 4 feet high, while some reach eight and ten feet in height, with diameters at the butt of from ½ inch to 2½ inches.

## TANTALUS FOREST.

During the year twelve cords of dead wood have been sold, the price received being seventy-five cents per cord on the stump. The trees being far apart and the great difficulty of getting at them owing to the dense growth of Lantana, is the reason of the low price.

An old trail commencing from the bend of the road below the forester's cottage, and crossing the Makiki Gulch to the top of ridge on the opposite side, has been cleared. The trail passes the patch of fruit trees alongside the stream, planted by the writer about ten years ago. There were planted at that time thirty-seven grafted Litchi nut trees *(Nephelium litchi)*, twenty-four Florida peaches and four varieties of Fig trees, two of each. Two or three years after planting, at the request of the then Commissioner of Agriculture and Forestry, a number of the trees were lifted and sent to town. On September 18th, 1905, the writer, with one of the laborers from the Nursery, inspected and cleared away the vines and grass from the trees. Although almost covered with Ipomoea vines,

most of the peaches and four Litchi trees were still alive. One of the Litchi trees is ten feet high and has a spread of branches about fifteen feet and is in a healthy condition; the other three Litchi trees, although smaller, are also in a healthy condition.

In a small gulch on the mauka side of the road at the bend just above Commissioner Thurston's place, three kinds of Olive trees were planted about ten years ago. The number and names are as follows:

26 *Olea polymorpha,*
25 " *manzanillo,*
50 " *nevadillo.*

Many of these have perished, but there are still alive twenty-five of them, some being ten feet high and looking healthy. The brush has been cleared away so that they will have a chance to grow. A little below the Olives on the same side of the road are to be found several trees of the Japanese Chestnut, now in fruit, planted at the same time. The piece of land on which the Chestnuts are growing was, I am informed, sold several years ago to Mrs. Foster.

I would suggest that such valuable trees as these be kept clear of brush and vines, should they be on Government land.

Respectfully submitted,

DAVID HAUGHS,
Forest Nurseryman.

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## Reports of District Foresters.

Early in January the Superintendent of Forestry sent to each of the District Foresters a copy of the following letter. The reports received in response thereto are given below:

LETTER FROM THE SUPERINTENDENT OF FORESTRY.

Honolulu, Oahu, Jan. 4, 1906.

Dear Sir:—In accordance with the terms of the law creating

the Board of Agriculture and Forestry an annual report for the calendar year 1905 is being prepared by the members of the Board staff. As a part of the report of the Division of Forestry I wish to include statements from the several District Foresters throughout the Territory. It is expected that the manuscript of the report as a whole will go to the printer early in February. The reports from the District Foresters should therefore, if possible, be submitted to me on or before February 3rd.

As one of the objects of the publications of the Board is to record and make available the results of forest work done in the Territory, I should be glad to get information on the following points:

*Seeding habits of native and introduced trees:* Season and period of seeding, recurrence of seed years, age and size at which seed bearing begins, notes on species seeding heavily in 1905, etc.

*Dates of introduction of valuable trees and shrubs:* Historical notes as to the name of the person by whom, and the place and time at which valuable trees and shrubs were introduced into your section. Dates of forest plantations, large wind brakes and extensive road-side planting are also in order.

*Injuries to the forest during 1905:* Notes on forest fires, duration, type of fire, area burned over and damage; notes on old forest fires, dates and approximate areas; insect injuries, extension or decrease of damage, new pests noted; injuries from fungi and other causes.

*Forest planting in 1905:* Forest Plantations, wind brakes or road-side planting during the year; location, area, kinds of trees, etc.; prospects for future planting.

*Forestry in general:* Notes of interest on any forestry matters.

In general character and scope the 1905 report will conform to first report of the Board, issued last spring. May I ask you to contribute a short statement dealing with one or all of the above subjects?

Thanking you in anticipation for your contribution, I am,

Very sincerely yours,

RALPH S. HOSMER,
Superintendent of Forestry.

REPORT OF MR. FRANCIS GAY.

*Waimea, Kauai.*

Makaweli, Kauai, Jan. 27th, 1906.

Mr. R. S. Hosmer,

Honolulu, Oahu.

Dear Sir:—In answer to your letter of the 4th inst. I would state that since my last report to you we have put in considerable time killing off the wild cattle from the forest lands, the expense of which has been borne by our firm of Gay and Robinson, on the lands controlled by us, and by the Knudsen Brothers, on the lands controlled by them.

Fencing on these lands is not necessary at present, as the adjoining pasture lands have no cattle running on them.

I found it necessary to make quite a number of trails, or horse paths in the mountains to facilitate the hunting and thereby was able to kill off about a hundred head of cattle, and this season when the dry weather sets in, from July to October, I propose to press the hunting into the swampy country as far back as the cattle run. This hunting will have to be done on foot as a great part of last year's was.

Our camps will have to be moved back further into the swamps, and the hunting will be a much harder task than that last year was.

In regard to forest planting I would say that our mountains are so well wooded with native trees, that I think it is not necessary to plant foreign trees, but if there was a sum appropriated for that purpose, some foreign trees would be an advantage.

In regard to forest fires I would state that for years our system has been to pay well every person who is present at, and helps to extinguish a fire. He is paid out of a fine imposed on the person starting the fire, and as the people are well paid they all turn out on the first sign of a pasture or forest fire.

Only one small forest fire occurred last year and that was quickly extinguished.

I have not noticed any new pests, nor injuries from fungi or other causes, and our forests look better now than they have for some years back, owing to the cattle being reduced.

As I stated to you in my last report our lowlands are well wooded with Algaroba, which was started years ago by ourselves and other land holders in the district, and now we are all reaping the benefits of our labors.

Yours very truly,

FRANCIS GAY.

REPORT OF MR. GEORGE H. FAIRCHILD.

*Puna, Kauai.*

Kealia, Kauai, Feb. 3rd, 1906.

R. S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu.

Dear Sir:—In reply to your letter of the 4th ult., I have nothing to offer in the way of a report beyond that which has been already submitted by others pertaining to the establishment of a forest line across the lands of Olohena, Waipouli, Kapaa, Kealia, Anahola and Kamalomaloo.

Nothing has been done in the matter of observing the "seeding habits of trees;" no new trees have been introduced; no forest fires to record or other injuries beyond those effected by cattle and old established pests.

The early fencing of the boundary line protecting the forest from cattle will be an important factor in forestry in this district where firewood is becoming scarce and the forest fast receding into the watershed.

I have noticed in a few places where the cattle have been kept out by ditches or other obstacles that many young thrifty Ohia trees are springing up. That the early establishment of the forest fence must precede all other efforts is self-evident and, to my mind, constitutes the prime matter for consideration in this district.

Respectfully submitted,

G. H. FAIRCHILD.

REPORT OF MR. FRANK SCOTT.

*Koolau, Kauai.*

Kilauea, Kauai, T. H., Jan. 27, 1906.

Mr. Ralph S. Hosmer,
Superintendent of Forestry,
Honolulu.

Dear Sir:—Your favor of the 4th inst. received and contents noted. In regard to a report from the District Foresters I would say that I know very little about forestry. I have got a little data on forest fires in this district which may be of some interest to you.

In 1886 there was a fire on Mahale, on the edge of Kalihiwai gulch, which lasted two days and burned over 150 acres. There were two in 1890, one on Kamookoa ridge, which lasted four days and burned over 200 acres; the other one was on Pohakualeale, which lasted five days and burned over 300 acres. In 1904 there was a fire on the edge of Mooloa gulch, which lasted about one week and burned about 250 acres. The trees that were destroyed were principally Ohia Lehua.

There were planted around Kilauea about 17 years ago several clumps of trees, in all about 20 acres, principally Ironwood and Eucalyptus, both of which seem to do well. Last year Mr. Moore tried to interest the Japanese in planting some trees in commemoration of the fall of Port Arthur, but the scheme failed to mature.

Very sincerely yours,
F. Scott.

REPORT OF MR. A. M. NOWELL.

*Waialua, Oahu.*

Waialua, Oahu, Feb. 2, 1906.

Mr. R. S. Hosmer,
Superintendent of Forestry,
Honolulu, Oahu.

Dear Sir:—In response to your letter of Jan. 4th, I would say that I had hoped and expected, this year, as I so stated in my last year's report to you, to be able to report something

definite in the way of the establishment in the Waialua District, of Forest Reserves, Nurseries or Planted Forests.

I am, however, not able to do this as there has been nothing actually accomplished, in any of the above lines, during the past year, though I take pleasure in referring to the inspection made by you and myself, last October, of the upper Halemano and Kawailoa lands, and the present line of the forest fence above these lands.

The chief evils which could befall these forests of the Koolau Range, by far the most extensive and valuable forests in this district, are those of destruction. 1st by *fire*, 2nd by *cattle*, 3rd by *injudicious cutting*, and 4th by *injurious insects*.

The Waialua Agricultural Company, Limited, which controls these lands, has finally succeeded in effecting the removal by their owners of the cattle which have for many years been ranging there. This accomplishment at once minimizes the danger from both *fire* and *cattle*, as the greater part, if not all of the fires which have occurred on these upper lands in the past few decades have been caused by cattlemen.

As to danger from *injudicious cutting*, Mr. Goodale, manager of the Waialua Agricultural Company, Limited, is very thoroughly aware of the *immense value* to his plantation of the mountain water which he has conveyed from the watershed to the canefields, and not only this, but he also realizes that the preservation of these forests means the preservation of the streams, the waters of which the plantation is using. I therefore consider that danger to these forests from injudicious cutting, for the present at least, is also minimized.

As to danger from *injurious insects*, I have noticed that areas exposed to the ravages of cattle are more susceptible in their weakened condition to the attacks of insects, and I therefore conclude that with the successful removal of all cattle from these lands, the danger from insect pests will be, at least, lessened.

*Injuries to the forest during 1905:* Last March, a fire started in grass land at Wahiawa, soon got beyond control, and before it was finally overcome had burned over an area of about 800 acres on the Koolau side of the Wahiawa Tableland. Of this area, only about 200 acres is in Waialua District, the greater portion being in Waianae Uka.

Of the total area burned, it is estimated that 500 acres was forest, the remainder grass land. The fire was fought by men furnished by the Waialua Agricultural Company, Limited, the Wahiawa Water Company, and the Oahu Sugar Company. The Waialua men were sent to the scene by Manager Goodale, immediately on the realization that they were needed, and they worked under the direction of Mr. George Watt, Head Overseer for the Waialua Agricultural Company, Limited, and Mr. David Haughs, Forest Nurseryman for the Board of Agriculture and Forestry.

Among others who were instrumental in suppressing this fire were Mr. Buick and several of the land owners of the Wahiawa Settlement.

This fire burned for several days and at times was making such headway that it threatened an immense area of heavily wooded forest. Its progress was finally stopped by the combined efforts of a large number of men who cut a swath 20 feet wide ahead of the advancing fire.

*Rainfall:* The rainfall in this district, at about 30 feet elevation, for the past five years, has been as follows:

1901, 35 inches; 1902, 27 inches; 1903, 16 inches; 1904, 66 inches; 1905, 18 inches; making an average yearly rainfall of 32 inches.

Five miles inland, at an elevation of 1,000 feet, the average yearly rainfall is about 65 inches or double that at the 30 foot elevation, while at ten miles inland there is approximately 125 inches of rain every twelve months, or 4 times as much as at the lowest elevation quoted.

*Outlook for 1906:* I believe that something should be done this year in the way of reforestation of the lands just below the present forest fence. In that case a nursery should be established at once. I believe that satisfactory arrangements could be made with the Waialua Agricultural Company for the carrying on of work of this kind on lands controlled by them. There are certainly a good many acres of lands, not now in forest, that will never be planted with sugar cane. Why not make them forest?

Respectfully submitted,

A. M. NOWELL.

## REPORT OF MR. JOHN HERD.

*South Koolaupoko, Oahu.*

Maunawili Ranch,

Waimanalo, Oahu, Jan. 24th, 1906.

Ralph S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu.

Dear Sir:—In compliance with your request, I herewith submit a statement of forest conditions in this section for the past year.

*Seeds:* As a rule, the trees in this section seed during the months of July and August. Unfortunately the seed of the native Koa in this district is entirely destroyed by a small worm which attacks the pods. The same trouble applies also to the seeds of Pride of India. Casuarina (Australian Beef Wood) has been seeding abundantly. *Grevillea robusta* is backward in this respect, seven-year old trees having borne so far very few seeds.

*Trees Set Out:* Since my last annual report there have been set out in this section 2,323 trees, mostly of economic importance, of which 1,500 are of the native Koa. This makes a total of 17,233 trees planted out by me on the Maunawili Ranch property under instructions of Messrs. W. G. Irwin and W. M. Giffard, since 1902. A number of trees set out as above during the past year were for the purpose of filling up "blanks" from former plantings.

*New Varieties Introduced:* A large number of trees, etc., of economic value have been introduced into this section by Mr. W. M. Giffard, among which are Teak *(Tectonia grandis)* from India. Mangosteen from the Strait Settlements, varieties of Rubber, Manila Hemp *(Musa textilis)*, *Monstera deliciosa*, *Anona muricata* and *Artocarpus integrifolia*. All the above were propagated from seed by Mr. Giffard and sent to this section for experimental purposes.

*Pests:* The Alligator Pear trees are being attacked by a

small beetle borer, and large numbers of these have been destroyed, supposedly, by this means. It is, however, quite possible that the *real* cause of their destruction is some fungus which attacks the roots and renders the tree unhealthy. This latter condition in turn would invite the work of the borers referred to. Until I can get this matter determined by either a plant pathologist or an entomologist I cannot fully decide the question. It is important that these and other troubles caused through fungi on this ranch and in this district be investigated by the department having such matters in charge. Other pests in the district are the worms which destroy the *Acacia koa* and other tree seeds, and a fungus which attacks the fruit of the Mango to the extent that no fruit has come to maturity for the last four years. Another fungus which is liable to become very serious is that which attacks the berries on coffee trees and also the leaves. The pests above referred to exist on other islands besides this one, and it is time steps were taken to have a plant pathologist determine these fungi and suggest remedies—otherwise large areas of land planted with trees of economic value are liable to become unproductive in the near future.

In addition to the above pests I might mention that of the common Guava, which has over-run this district. This tree has been increasing rapidly during the past few years along the windward side of this island, and in this district is killing out large numbers of the Ohia Ai, Ohia Lehua and Kukui trees. It was formerly the custom in this section to lease out to Chinese and others areas of land covered with Guava trees for the purpose of making charcoal from the same. The result of this system was temporarily of financial benefit to the owner of land, but it eventually resulted in causing the roots of the Guava trees so cut to increase in enormous quantities through the suckers produced from the roots, and thereby make the land absolutely impassible to the rancher in caring for the cattle roaming over the same. It has also resulted in ruining the feed upon which the cattle subsist, causing the grasses to sour, and the cattle to get in poor condition. After a few months' experience in this district I came to the conclusion that it did not pay to cut Guava trees for char-

coal or other purposes unless the roots are thoroughly eradicated from the soil. In sections where the charcoal burner was not allowed to work the original Guava trees have grown to quite a height without suckering from the roots and are far enough apart in themselves to allow a passage for man and beast between and under them. I find also that these trees produce much larger fruit than the scrub Guava, caused by the suckering of the trees which have been hewn by charcoal burners. Upon my recommendation, the owners of the ranch have for the past two years refused to rent out any Guava lands to the charcoal burners.

Among other pests similar to Guava is the Lantana, which has also fairly over-run portions of the district. In this particular section, however, I have been able to keep it down to a considerable extent, and it would be well if other property owners in the neighborhood did likewise, notwithstanding the fact that there is a possibility of its not spreading as much now as in the past, because of the insect enemies which have been introduced through the Territorial Government for preventing the further propagation of the seed.

*Fencing:* Since my last report three small forest reserves on the Maunawili Ranch have been fenced in by order of its owner. This was done in order to protect the native forest near the foothills.

Respectfully submitted,

JOHN HERD,
Forester.

REPORT OF MR. G. C. MUNRO.

*Island of Molokai.*

Molokai Ranch,
Kalae, Molokai, Feb. 1, 1906.

Mr. Ralph S. Hosmer,
Superintendent of Forestry,
Honolulu.

Dear Sir:—In answer to yours of January 11th, I am sending a few lines on our forest and regret that I have been able

to spend little time in the forest region and so have little to tell.

The protected forest of Molokai continues to improve in condition, the growth on the partly denuded areas being especially noticeable, ferns and young trees in some places forming a dense covering where a few years ago the ground was almost bare. There is a great need of some quick growing, self-spreading trees to make more variety in the forest. Many have been tried but none found altogether satisfactory. No great area of trees has been planted on Molokai in the past year, probably not more than a few thousand trees. In 1906 larger plantations will likely be made; several acres of Black Wattle will be planted in one location.

Yours very truly,

G. C. MUNRO.

REPORT OF MR. C. B. WELLS.

*Wailuku, Maui.*

Wailuku, Maui, T. H., Jan. 23, 1906.

Mr. Ralph S. Hosmer,
Superintendent of Forestry,
Honolulu.

My Dear Sir:—In reply to your esteemed favor of the 4th inst., I regret to say I have nothing of value to contribute for your report.

There have been no injuries to the forest during 1905, nor have any steps been taken in the way of forest planting.

I desire to go into forest planting for the Wailuku Sugar Company and have been waiting many months for you to visit Wailuku in order to get your valuable opinion as to what is best to be done and to act in accordance with your advice.

Very truly yours,

C. B. WELLS.

REPORT OF HON. H. P. BALDWIN.

*Forester at Large, Maui.*

Puunene, Maui, Feb. 2nd, 1906.

Ralph S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu.

My Dear Sir:—I have not been able to write much of an article for your Annual Report, for lack of time. Moreover, I am not well posted and cannot now give much information on the two first items you requested me to write upon, to-wit:

*"Seeding Habits of Native and Introduced Trees."*
*"Dates of Introduction of Valuable Trees and Shrubs."*

I will endeavor to post myself more thoroughly on these two subjects, before your next Annual Report comes out.

*Forests during 1905:* The rainfall was quite heavy during the summer of 1905, especially in the mountain forests.

The total rainfall in Keanae in 1905 was 247.90 inches, and 126.03 inches at Kailua, where W. F. Pogue resides. The rainfall was well distributed in both places throughout the year.

We had but few forest fires through the year. This was due very largely to the fact that the underbrush was kept wet by the rain most of the time.

*Forests planted in 1905:* Aside from planting several thousand trees on our sugar plantations here, but little was done in the way of forest planting.

The forest reserve fence is now completed and we will take steps this year to renew the forests, where the mountain slopes have been denuded of trees.

*Forests in general:* Carrying out the proposition of the Forest Reserve Agreement, between the Government and the Hawaiian Commercial and Sugar Company, Paia and Haiku Sugar Companies, to reserve and protect certain of the forest lands of East Maui, the above mentioned plantations have completed the fence enclosing said forest, and also a large

tract, not included in said forest reserve, on the "makai," or sea side, of the forest, so that all animals are kept out of the forests.

W. F. Pogue, the superintendent of our large water aqueducts, has general charge of said forests, with instructions to keep the fence in repair. The fence runs from Halehaku Gulch to the eastern terminus of our so-called Koolau aqueduct in Nahiku. This fence was built by the above mentioned plantations last year, and I am happy to say that already the young forest trees are starting to grow and thrive, where the trees had been destroyed by cattle, horses and forest fires.

A large part of the Nahiku forest land, as you know, was cleared by the Nahiku Sugar Company to plant cane.

Two rubber companies have been organized to grow rubber trees on these lands, and a third company will, in the near future, be organized for the same purpose, so that a large part of the Nahiku lands, that were denuded of forest trees, will soon be covered again with trees, which will prove, in my opinion, a fair substitute for the dense natural forests of that district for conserving the rainfall.

It is our intention to renew the forests, as far as possible, in the districts that our irrigation aqueducts run through.

I remain, Yours very truly,

H. P. BALDWIN.

REPORT OF MR. J. M. ROSS.

*North Hilo, Hawaii.*

Hakalau, Hawaii, T. H., Jan. 16, 1906.

R. S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu.

Dear Sir:—Yours of Jan. 4th regarding annual report of Agriculture and Forestry. In my district there is very little hat I am able to report upon.

*Seeding habits of Native and Introduced Trees:* Introduced trees, there are none in this district with the exception of a few around plantation dwellings. Their seasons of seeding and bearing are already too well known to you to require any remarks from me.

*Dates of introduction of valuable trees:* There have been none introduced into this district during my time, that I am aware of.

*Plantation windbrakes or roadside plantings:* There are no windbrakes in this district and practically no roadside planting.

*Forest fires:* There have been no forest fires in this district to speak of, all of the forest being remarkably well preserved from the inroads of cattle, fires or pests. Tree ferns and underbrush are so dense right out to the forest edge that it is with difficulty you can cut your way in for any distance, even with the help of a cane knife.

*Forest planting, 1905:* None.

*Forestry in general:* Under this head the only thing that might interest you is that when the Ohia forest is cut down the Koa springs up with remarkably rapid growth. On Hakalau Plantation we had about 20 acres of Ohia forest cut down and partly cleared for cane, that is the stumps were not taken out. The larger logs are also left lying where they fell, only the smaller trunks and underbrush being burnt up. In this condition it was planted to sugar cane without any attempt at plowing. The seed cane was planted in rows dug out with mattocks. One fair crop of plant cane was harvested but when the cultivation of the ratoon crop came along, owing to scarcity of labor, it was deemed advisable to abandon the tract. The succeeding year it was noticed that a thick growth of young Koa was springing up.

That was about eight years ago. Today there is a dense forest of Koa trees, with tree ferns and underbrush as dense as the original Ohia forest. A great many of the Koa trees

today will measure from ten to twelve inches in diameter, and from fifteen to twenty feet in height.

Yours respectfully,

J. M. Ross,
District Forester, North Hilo.

REPORT OF MR. J. A. SCOTT.

*South Hilo, Hawaii.*

Wainaku, Hilo, Hawaii, Jan. 25, 1906.

Ralph S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu.

Dear Sir:—Yours of the 4th inst. was received in which you request information regarding the forest in this section.

*Seeding habits of native trees:* The Koa is the most prolific seeder in this section, as whenever the forest is removed a magnificent growth of young Koa springs up, and with proper care and thinning would, in a few years, produce very valuable lumber.

*Dates of introduction of valuable trees and plants:* Avocado or Alligator Pear was first introduced into these islands in June, 1853, being brought here in the U. S. ship "Portsmouth," from Central America by Purser Bridge. He gave the plant to Rev. Titus Coan, pastor of the Haili Church in Hilo, who planted it in his grounds where it exists today in good condition. The Rose Apple was brought here at the same time, by the same gentleman.

I received this information from Mr. Luther Severance, who was in Hilo on the arrival of the U. S. ship "Portsmouth."

*Injuries to the forest by fires:* During the year 1905 there has been no damage done to the forest by fires, and credit is due to the care exercised by those in charge of the lands bordering on the same.

The rainfall during the latter half of the year 1904 was below normal, and as it was extremely dry the first three months of 1905, the forest was placed in great danger from fires, owing to the great amount of dry material covering the ground.

*Forest planting:* There has been nothing done in this line in this section during the past year. And as to windbrakes, there is no necessity for them in this section, as the regular trade winds are moderated by the formation of the lands on this island.

Respectfully submitted,

JOHN A. SCOTT.

REPORT OF HON. GEORGE C. HEWITT.

*West Kau, Hawaii.*

Waiohinu, Kau, Hawaii, Jan. 15, 1906.

Ralph S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu.

Dear Sir:—In answer to your letter of January 4th, I would say in answer to the various inquiries that I have no knowledge of most of them, as there is very little chance in this district to acquire the information requested. This is the case with the request as to seeding habits of native and introduced trees.

In regard to inquiry No. 2, I would say that in 1889 or 1890 the Hutchinson Sugar Company secured the services of Mr. David Haughs, who remained with them several years as Forester. Mr. Haughs planted many different varieties of trees, having brought a large supply of seeds from Scotland and labored faithfully to secure the results desired. The result was not encouraging owing to various reasons and not many of the trees survived. The Algaroba was extensively planted, but did not seem to grow for the reason perhaps that the elevation was too great. The Ironwood, Monterey Cypress

and Japanese Plum were the ones that were the best perhaps —among the many planted—but drought and cattle retarded the growth to a large extent.

There have been no forest fires during 1905 in this section, in fact none for many years.

I have no knowledge of any forest plantations, either for windbrakes or roadside planting.

The Hutchinson Sugar Company has extended a fence from the fence of the Hawaiian Agricultural Company across the lands of Hilea, Ninole, Kaalaiki, Waiohinu and Kiolakaa, along the Kahuku boundary; thence along Kahuku to the lower end of Kiolakaa; thence across to the Waiohinu lands which practically encloses the whole of these lands, the fence being some seventeen miles long. The Kiolakaa lands enclosed are some seven thousand acres of forest. The other lands mentioned contain many thousand acres more. This fencing will keep out the wild cattle. It is already showing good results and will be of great benefit. The ravages of cattle were not as bad at this end of the district as at the eastern end, owing to the fact that there is more rainfall on these uplands and to the numerous swamps, where cattle cannot travel and where the vegetation is very dense so that there is very little grass.

Along the Kona road there is very little change in the forests. In fact below the road the forest seems to be increasing. Many of the various lava flows are being seeded into various shrubs, the seeds of which are carried by birds. But owing to the absence of soil upon these flows this natural planting will not be likely to show many results for years. There seem to be no wild cattle in these forests, so far as I have observed, below the government road. Above the road I have no information, but presume at the higher elevations, they are plentiful. The rainfall is not as heavy and the country is more open than along the Kau forest of Waiohinu, Kaalaiki and Kapapala. As far as I can learn the forests in this district are as a whole increasing.

Yours very truly,

GEORGE C. HEWITT.

REPORT OF MR. ERIC H. EDWARDS.

*South Kona, Hawaii.*

Hoopuloa, Hawaii, April 12, 1906.

Mr. R. S. Hosmer,
Superintendent of Forestry,
Honolulu.

Dear Sir:—As requested I herewith beg to hand you a resume of what has come under my notice, since I took charge of the estate of the late Mr. F. Buchholtz, "Papa Ranch."

*The estate* is situated at the southern end of South Kona, and runs from the beach up to an elevation of about 5600 feet. The trees were planted by Mr. Buchholtz during the years 1897-1902. Most of them are planted at an elevation running from 1300 to 1700 feet. Though planted on very rocky land they have, however, done remarkably well.

*Forest trees of commercial value:* Ironwood, Grevillea robusta, Lebanon Cypress, Camphor, Castilloa elastica, and several others whose names I am not able to mention.

Last year, 1904, the Ironwood planted in 1898 bore seed for the first time, and this year, 1905, blossomed in June and seeded some time in December. The trees have also sent out numerous shoots from the roots of the parent tree; some of these shoots are now good sized trees. The largest parent trees have a diameter of about 15 inches, at two feet from the ground, and have attained a height of some 40 feet.

To the best of my knowledge the Grevillea blossomed in July or August last, for the first time, and seeded in November. This tree is evidently well adapted to the rocky soil, and is now, after a seven years' growth, quite a marketable tree. Also, Grevilleas, planted at an elevation of 2450 feet have, in three years, reached a height of from 16 to 20 feet. The other trees mentioned have not blossomed, but have made fair growth, more especially the Lebanon Cypress.

The Camphor trees, planted at 2300 feet elevation, have also made a good growth, but not being protected against stock do

not get a fair show. This tree would, I think, make a good windbreak, as it is a quick grower and the foliage is very dense.

*Fruit trees* of numerous varieties have been planted, but have not had the necessary care for the past year and a half; previous to that, I understand that apple and pear trees bore well. Avocado pear, peach and fig bear well yet; apples lightly.

*St. John's Bread*, planted at 1700 feet elevation, does well as far as growth is concerned; blossoms in May and June, but does not fruit.

*The Lantana fly* seems to be rapidly doing away with the Lantana, but I am inclined to think it attacks other trees and plants besides the Lantana. One of the worst pests which does damage to trees and pasture is the grasshopper, which is ever on the increase.

At the latter end of February, 1905, fire broke out in the forest at Opihale, near here, spreading over to Kipahoehoe, and lasting until near the end of March. The area covered by the fire was about 1000 acres, the forest being practically destroyed, and the mould which had been forming for years gone by, has smouldered away, leaving the rocks bare.

Yours truly,

ERIC H. EDWARDS.

REPORT OF MR. W. R. CASTLE.

*South Kona, Hawaii.*

Honolulu, T. H., March 16, 1906.

Mr. Ralph S. Hosmer,

Superintendent of Forestry,

Honolulu.

Dear Sir:—In answer to your letter requesting a report as to forestry conditions in South Kona, I beg leave to reply as follows:

*Planted forests:* Unless something has been done in this line which has not been brought to my notice—and a recent visit to Kona having forestry conditions in view has not disclosed such a fact—there has been nothing done in 1905 in planting new forest trees, but there has been a pretty vigorous growth with some trees which were planted before. I refer more particularly to Eucalyptus, which has been planted to some extent, although not with a view to forestry so much as furnishing a shade on some of the lower lands.

*Forest nurseries:* Do not exist in this district. There has, however, been some collection of Koa seeds from the mountains with the intention of starting such a nursery at the South Kona Agricultural Company's headquarters at Kalahiki.

*Native forests:* The present condition of this forest seems to be upon the whole good. It has not been possible to visit the upper line of the forest on the mountain during the past year, but from information furnished, I am afraid that the ravages of cattle and goats in destroying the undergrowth has resulted in opening up fields for insect destroyers, which fields are being eagerly cultivated by these pests. I am informed in this particular that more trees on the upper edge of the forest appear to be dying than could be accounted for by age or other conditions.

*Forestry in general:* I may say that from my recent trip on the island of Hawaii it is my observation that in South Kona the general appearance of the forest is healthy, and there is a spread of the same. A large growth of young Koa is coming up where cattle do not interfere, and on the outside of the woods in common with other parts of the island there seems to be a large increase in the growth of Mamani.

The great fire in the woods of Alika and Kaapuna of February and March, 1905, has been succeeded throughout a large extent of the area burned over by a very vigorous growth of young timber, as well as ferns and grasses. If cattle could be kept away from this region there is no doubt that the burned

area would soon be covered by healthy and vigorous growth of young timber.

Respectfully submitted,
W. R. CASTLE.

REPORT OF MR. JOHN A. MAGUIRE.

*North Kona, Hawaii.*

Huehue, Kailua, Hawaii, Feb. 3, 1906.

Mr. Ralph S. Hosmer,
Superintendent of Forestry,
Honolulu.

Dear Sir:—In reply to yours of January 4th, asking for a report on forestry in my district, I have to state that owing to the unusual drought of 1905 the forests of North Kona suffered a great deal. The inroads made by cattle in their search for moisture and feed have been very great.

The Government cannot afford to make any delay in setting apart and fencing the forest reservation of Honuaula.

The storms of last month coming immediately after the long drought have hastened the denudation of the forests. Gigantic trees were simply mowed down. The underbrush and ferns having been killed by the drought and the cattle, the wind had a clear sweep through the forests.

Trees that withstand drought: The *Grevillea robusta* is the finest tree to withstand drought. It actually glories in it, for it kept in a constant mass of blossoms for nearly a year during the 14 months drought and seeded well. The recent rains have started the seedlings to shoot forth in solid masses. The Grevillea is also a good wind resisting tree.

Trusting that this year will be more favorable, I shall hope to make a better report next year.

Yours very sincerely,

J. A. MAGUIRE,
Forester, North Kona, Hawaii.

No reports were received from the other District Foresters.

## LIST OF THE DISTRICT FORESTERS.

Following is a list of the District Foresters, with their respective jurisdictions:

**KAUAI.**

ALBERT S. WILCOX.

In and for the District of Halelea.

FRANK SCOTT.

In and for the District of Koolau, excepting the land of Anahola.

GEORGE H. FAIRCHILD.

In and for the land of Anahola and the northern portion of the District of Puna, extending as far as the land of Wailua.

F. WEBER.

In and for the southern portion of the District of Puna, from and including the land of Wailua.

REV. J. M. LYDGATE.

In and for the east half of the District of Kona.

FRANCIS GAY.

In and for the District of Waimea.

**OAHU.**

PAUL R. ISENBERG.

In and for that portion of the District of Kona extending from Makapuu Point to and including Manoa Valley.

WALTER F. DILLINGHAM.

In and for the Districts of Ewa and Waianae.

A. M. NOWELL.

In and for the District of Waialua.

ANDREW ADAMS.

In and for the District of Koolauloa.

L. L. McCANDLESS.

In and for that portion of the District of Koolaupoko extending from Koolauloa to the land of Heeia.

C. BOLTE.

In and for that portion of the District of Koolaupoko extending from and including Heeia to the land of Kailua.

JOHN HERD.

In and for that portion of the District of Koolaupoko extending from and including the land of Kailua to Makapuu Point.

**MOLOKAI.**

G. C. MUNRO.

In and for the Island of Molokai.

**LANAI.**

CHARLES GAY.

In and for the Island of Lanai.

**MAUI.**

L. BARKHAUSEN.

In and for the District of Lahaina.

C. B. WELLS.

In and for the District of Wailuku.

H. A. BALDWIN.

In and for the District of Hamakuapoko and the western half of the District of Hamakualoa.

W. F. POGUE.

In and for the District of Koolau and the eastern half of the District of Hamakualoa.

L. VON TEMPSKY.

In and for the District of Makawao.

L. VON TEMPSKY and DR. J. H. RAYMOND.

In and for the Districts of Kula, Honuaula, and the lands beyond, to and including Kaupo.

H. P. BALDWIN.

District Forester at Large for the Island of Maui.

## HAWAII.

T. S. KAY.

In and for the District of North Kohala, and that portion of the District of Hamakua lying between the District of North Kohala and Waimanu Valley.

F. W. CARTER.

In and for the District of South Kohala.

DAVID FORBES.

In and for that portion of the District of Hamakua from and including the Waimanu Valley to the District of Hilo.

JOHN M. ROSS.

In and for that portion of the District of Hilo extending from the District of Hamakua to the land of Makahanaloa.

JOHN A. SCOTT.

In and for that portion of the District of Hilo extending from the District of Puna to and including the land of Kikala.

JOHN WATT.

In and for the District of Puna.

JULIAN MONSARRAT.

In and for that portion of the District of Kau extending from the District of Puna to and including the land of Punaluu.

GEORGE C. HEWITT.

In and for that portion of the District of Kau extending from the land of Punaluu to the District of Kona.

ERIC H. EDWARDS.

In and for that portion of the District of South Kona extending from the District of Kau to the land of Kaohe.

WM. R. CASTLE and GEO. W. McDOUGALL.

In and for that portion of the District of South Kona extending from and including the land of Kaohe to the District of North Kona.

JOHN D. PARIS.

In and for that portion of the District of North Kona extending from the District of South Kona to and including the land of Kahaluu.

JOHN A. MAGUIRE.

In and for that portion of the District of North Kona extending from Kahaluu to the District of South Kohala.

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## LIST OF DISTRICT FIRE WARDENS.

Following is a list of the District Fire Wardens, with their respective Districts:

**CHIEF FIRE WARDEN**

RALPH S. HOSMER,

Superintendent of Forestry, *ex officio*.

**DEPUTY FIRE WARDEN AT LARGE**

DAVID HAUGHS.

In and for the Territory of Hawaii.

**DISTRICT FIRE WARDENS.**

**KAUAI.**

FRANK SCOTT.

In and for the District of Koolau, excepting the land of Anahola.

GEORGE H. FAIRCHILD.

In and for the portion of the Districts of Koolau and Puna, extending from the land of Anahola to the land of Olohena, inclusive.

F. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua.

REV. J. M. LYDGATE.

In and for that portion of the District of Kona, formerly known as the District of Koloa.

FRANCIS GAY.

In and for that portion of the District of Kona, formerly known as the District of Waimea.

## OAHU.

ANDREW ADAMS.

In and for the District of Koolauloa.

FRANK PAHIA.

In and for that portion of the District of Koolaupoko, extending from the Koolauloa District line to the land of Heeia.

C. BOLTE.

In and for that portion of the District of Koolaupoko, extending from and including Heeia to the land of Kailua.

JOHN HERD.

In and for that portion of the District of Koolaupoko, extending from and including the land of Kailua to Makapuu Point

W. M. GIFFARD.

In and for that portion of the District of Kona, lying between Pauoa and Manoa Valleys.

H. J. RHODES.

In and for Palolo Valley, District of Kona.

F. MEYER.

In and for that portion of the District of Waianae lying to the West of the Waianae Mountains.

WALTER F. DILLINGHAM.

In and for the District of Ewa and that portion of the District of Waianae lying to the East of the Waianae Mountains.

A. M. NOWELL.

In and for the District of Waialua.

BYRON O. CLARK.

For that portion of the Lands of Wahiawa and Waianae-uka, lying to the East of the main Government road from Ewa to Waialua.

## MOLOKAI.

G. C. MUNRO.

In and for the Island of Molokai, excepting that portion between the lands of Pukoo and Halawa, inclusive.

C. C. CONRADT.

In and for that portion of the east end of the Island of Molokai, between the lands of Pukoo and Halawa, inclusive.

**LANAI.**

CHARLES GAY.

In and for the Island of Lanai.

**MAUI.**

LOUIS BARKHAUSEN.

In and for the District of Lahaina.

C. B. WELLS.

In and for the District of Wailuku.

R. C. SEARLE.

In and for the District of Kaanapali.

H. P. BALDWIN.

Fire Warden at Large, for the Island of Maui.

L. VON TEMPSKY.

In and for the Districts of Kula and Kaupo.

J. H. RAYMOND, M. D.

In and for the Districts of Honuaula and Kahikinui.

H. A. BALDWIN.

For the District of Hamakuapoko and the west half of the District of Hamakualoa.

W. F. POGUE.

In and for the District of Koolau and the east half of the District of Hamakualoa.

JOHN CHALMERS.

In and for the District of Hana.

HUGO HANEBERG.

In and for the District of Kipahulu.

**HAWAII.**

T. S. KAY.

In and for the north half of the District of Kohala.

F. W. CARTER.

In and for the south half of the District of Kohala.

D. FORBES.

In and for the western part of the District of Hamakua, extending to the boundary of the land of Paauhau.

JAMES GIBB.

For that portion of the District of Hamakua, extending from the western boundary of the land of Paauhau to the boundary of the land of Kukaiau.

ALBERT HORNER.

In and for that portion of the District of Hamakua, extending from and including the land of Kukaiau to the Hilo District Line.

JOHN M. ROSS.

In and for that portion of the District of Hilo, extending from the land of Makahanaloa to the Hamakua District Line.

JOHN A. SCOTT.

In and for that portion of the District of Hilo, extending from the Puna District Line to and including the land of Kikala.

JOHN WATT.

In and for the District of Puna.

JULIAN MONSARRAT.

In and for that portion of the District of Kau, extending from the Puna District Line to and including the land of Punaluu.

CARL WOLTERS.

In and for that portion of the District of Kau, extending from the land of Punaluu to the Kona District Line.

ERIC H. EDWARDS.

In and for that portion of the District of Kona, extending from the Kau District Line to and including the land of Kaapuna.

GEORGE W. McDOUGALL.

In and for the portion of the District of Kona, extending from the land of Kaapuna to and including the land of Hookena.

JOHN D. PARIS.

In and for that portion of the District of Kona, extending from the land of Hookena to and including the land of Kaawaloa.

T. C. WHITE.

In and for that portion of the District of Kona, extending from the land of Kaawaloa to the land of Kahaluu.

JOHN A. MAGUIRE.

In and for that portion of the District of Kona, extending from the land of Kahaluu to the Kohala District Line.

WARNING NOTICE

# FOREST FIRE

## RULES and LAWS

All persons are warned not to set fires on Government Forest Land.

Fires for clearing land near a forest must not be started during dry times without permission of the District Fire Warden.

Fires for burning brush near a forest must be watched by competent persons until the fire is completely extinguished.

Fires for smoking out bees are prohibited on Government Forest Land.

Hunters and smokers are cautioned against allowing fires to start from cigars, pipes and cigarettes.

Especial care should be taken that lighted matches are extinguished before they are thrown down.

All persons are requested to report immediately any cases which come to their knowledge of injury to wood-land arising from a violation of these rules.

# LAWS OF THE TERRITORY OF HAWAII

## ACT 71 OF THE SESSION LAWS OF 1905

SEC. 1. FOREST FIRE SERVICE. It shall be the duty of the Board of Commissioners of Agriculture and Forestry to take measure for the prevention, control and extinguishment of forest fires within the Territory.

SEC. 5. SETTING FIRES. Every person who wilfully, maliciously or negligently sets on fire or procures to be set on fire any woods, brush, prairies, grass, grain or stubble on any lands not owned, leased or controlled by him whereby any property of another is injured or destroyed, and every person who accidently sets or causes to be set any fire on land not owned, leased or controlled by him, which spreads to the land of another, and allows said fire to escape from his control, without using every effort to extinguish it, shall be deemed guilty of a misdemeanor and liable to a fine of not less than twenty-five dollars nor more than five thousand dollars. Setting such fires or causing or procuring them to be set or allowing them to escape shall be prima facie proof of wilfulness, malice or negligence under this section; provided that nothing herein contained shall apply to a person who, in good faith, sets a back fire to check a fire already burning.

SEC. 6. FIRES TO CLEAR LAND. In times and localities of particular fire danger, the Chief Fire Warden may cause a warning to be issued that during a specified time fires to clear land, including the burning of fallows, stumps, logs, brush, dry grass, or fallen timber, shall not be started, unless the written permission of the District Fire Warden of the District in which the fire is set has been first obtained. Such fires shall not be started during a heavy wind or without sufficient help present to control the same, and the fire shall be watched by the person setting the same, or by competent agents of his, until put out.

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By Order of the Board of Commissioners of Agriculture and Forestry.

RALPH S. HOSMER,

Superintendent of Forestry and Chief Fire Warden.

# Forest Fire Law.

## ACT 71, SESSION LAWS OF 1905.

AN ACT.

TO PROVIDE FOR THE PROTECTION OF FOREST LAND WITHIN THE TERRITORY FROM FIRE.

Be it Enacted by the Legislature of the Territory of Hawaii:

FOREST FIRE SERVICE.

Section 1. It shall be the duty of the Board of Commissioners of Agriculture and Forestry to take measure for the prevention, control and extinguishment of forest fires within the Territory.

CHIEF FIRE WARDEN.

Section 2. The Superintendent of Forestry shall be ex-officio Chief Fire Warden. The Chief Fire Warden shall have charge of all the Fire Wardens of the Territory, and shall aid and direct them in their duties.

DISTRICT FIRE WARDENS.

Section 3. The Board of Commissioners of Agriculture and Forestry shall appoint in such number and localities as it deems wise, persons to act as District Fire Wardens. They shall promptly report to the Chief Fire Warden all fires in their respective district and take immediate and active steps toward their extinguishment, assist in apprehending offenders against this Act, and give all possible assistance to the Chief Fire Warden. For all services in extinguishing fires and in apprehending offenders, payment shall be made by the Territory, at the rate of twenty-five cents per hour for the time actually employed, provided that the payment for such services shall not in any case exceed one hundred Dollars to any one person for any one year.

POWERS OF FIRE WARDENS AND ASSISTANCE OF PERSONS IN FIGHTING FIRE.

Section 4. All Fire Wardens shall have authority to employ all able bodied male persons, between the ages of 16 and 50 years, in the district in which they act, for assistance in putting out fire.

Compensation for services in fighting fire shall be at such rate for the time actually employed as the District Fire Warden shall fix.

The Fire Warden in charge, shall submit time record and bill of the men employed, to the Chief Fire Warden, who shall examine and, if he approves it, shall forward the bill at once to the Auditor.

The District Fire Wardens shall have power to incur expenses for the transportation and other unavoidable expenses of fire fighters, and shall include the same, with necessary vouchers, in their accounts.

SETTING FIRES.

Section 5. Every person who wilfully, maliciously or negligently sets on fire or causes or procures to be set on fire any woods, brush, prairies, grass, grain or stubble on any lands not owned, leased or controlled by him; and every person who wilfully, maliciously or negligently allows a fire to escape from land owned, leased or controlled by him whereby any property of another is injured or destroyed; and every person who accidentally sets or causes to be set any fire on land not owned, leased or controlled by him, or sets or causes to be set any fire on land owned, leased or controlled by him, which spreads to the land of another, and allows said fire to escape from his control without using every effort to extinguish it, shall be deemed guilty of a misdemeanor and liable to a fine of not less than twenty-five dollars nor more than five thousand dollars. Setting such fires or causing or procuring them to be set or allowing them to escape shall be prima facie proof of willfulness, malice or negligence under this section, provided that nothing herein contained shall apply to a person who, in good faith, sets a back fire to check a fire already burning.

FIRES TO CLEAR LANDS.

Section 6. In times and localities of particular fire danger, the Chief Fire Warden may cause a warning to be issued that during a specified time fires to clear land, including the burning of fallows, stumps, logs, brush, dry grass or fallen timber, shall not be started, unless the written permission of the District Fire Warden of the District in which the fire is set has been first obtained. Such fires shall not be started during a heavy wind or without sufficient help present to control the same, and the fire shall be watched by the person setting the same, or by competent agents of his, until put out.

Section 7. This Act shall take effect from and after the date of its approval.

Approved the 26th day of April, A. D., 1905.

G. R. CARTER,
Governor of the Territory of Hawaii.

# Report of the Librarian.

Honolulu, T. H., Dec. 31, 1905.

Board of Commissioners of
Agriculture and Forestry,
Honolulu, Oahu.

Gentlemen:—At a meeting of the Board held on March 9th, 1904, it was resolved that "until further notice Mr. Ralph S. Hosmer be authorized and requested to take charge of the general offices, library, correspondence, records, and employees of the Board, with the exception of the members of the Entomological Division., subject to the control of the Board." As an outcome of the above action I have the honor to submit the following report covering the condition of the Board library, the office and other routine work of the Board, and the care and condition of the buildings and grounds during the past year.

## LIBRARY.

The Library of the Board of Agriculture and Forestry is now officially regarded as the Department of Natural Science of the Library of the Territory, and as such there are turned over to it the publications properly coming under this general head, received by other departments of the Government.

The aim of the Library is to cover the field of Agriculture in its large sense, especial attention being paid to the branches of Botany, Entomology, Forestry and Animal Industry, particularly in relation to subtropical conditions.

The Library is maintained as a free reference library, open to the public, daily, during office hours. It receives accessions through gift, purchase and exchange, and now contains somewhat over 4,000 books and pamphlets, not including the current publications regularly received.

The Library receives regularly all the publications of the several Bureaus and Divisions of the U. S. Department of Agriculture, of each of the State Experiment Stations in the Union, as well as those in Cuba and Porto Rico, and the Bureau of Science in the Philippines. It is on the exchange

list of the Departments of Agriculture in most of the British Colonies, in Australasia, the East and West Indies, and South Africa, as well as on those of several other foreign countries. Other publications regularly received are the reports and bulletins of the Smithsonian Institution and the U. S. National Museum, certain Divisions of the U. S. Geological Survey, the U. S. Department of Labor and Commerce, the Carnegie Institution of Washington, and the Field Columbian Museum of Chicago.

Current periodicals covering various phases of agriculture, especially those dealing with subtropical conditions, are received through exchange or subscription, together with a limited number of technical journals on special subjects. The names of fifty-three of the more important magazines now on file in the Library are given in the following:

*List of Periodicals Regularly Received by the Library of the Board of Agriculture and Forestry.*

Official Journals.

Agricultural Journal, Cape Town, South Africa.
Agricultural News, Barbadoes, West Indies.
Agricultural Gazette, Hobart, Tasmania.
Journal of Agriculture, Melbourne, Victoria.
Agricultural Gazette, Sydney, New South Wales.
Journal, Department of Agriculture, Perth, Western Australia.
West Indian Bulletin, Barbadoes, West Indies.
Journal, Jamaica Agricultural Society, Kingston, Jamaica.
Victoria Naturalist, Melbourne, Victoria.
Queensland Agricultural Journal, Brisbane, Queensland.
Boletim da Agricultura, Sao Paulo, Brazil.
Journal of Science, Manila, P. I.
Bulletin, College of Agriculture, Tokyo, Japan.
Crop Reporter, Washington, D. C.
Experiment Station Record, Washington, D. C.
U. S. Consular and Trade Reports, Washintgon, D. C.
Congressional Record, Washington, D. C.

Journals of Tropical Agriculture.

The Tropical Planter, Rochester, New York.
Tropical Agriculturist, Colombo, Ceylon.
Indian Planting and Gardening, Calcutta, India.
L' Agriculture Practique des Pays Chauds, Paris, France.
Journal D'Agriculture Tropicale, Paris, France.
Der Tropenpflanzer, Berlin, Germany.

General Agriculture and Special Industries.

The American Farmer, New York.
American Agriculturist, New York.
Rural New Yorker, New York.
Up to Date Farming, Indianapolis, Indiana.
Farm Journal, Philadelphia, Penn.
Gleanings in Bee Culture, Medina. Ohio.
India Rubber World, New York.
Tea and Coffee Trade Journal, New York.

Fruit Trade Journals.

California Cultivator, Los Angeles, California.
California Fruit Grower, San Francisco, California.
Pacific Fruit World, Los Angeles, California.
Rural Californian, Los Angeles, California.
Pacific Rural Press, San Francisco, California.

Forestry Magazines.

Forestry Quarterly, Ithaca, New York.
Forestry and Irrigation, Washington, D. C.
Arboriculture, Connerville, Indiana.
The Indian Forester, Allahabad, India.
Rod and Gun in Canada, Woodstock, Ontario.

Entomological Magazines.

Entomological News, New York.
The Entomologist, London.
Entomologist's Monthly Magazine, London.

Canadian Entomologist, Canada.
The Insect World, Japan.

General Science.

Science, New York.
Nature, London.
Popular Science Monthly, New York.

Local Magazines.

Hawaiian Forester and Agriculturist, Honolulu.
Hawaiian Planters' Monthly, Honolulu.
Paradise of the Pacific, Honolulu.
The Friend, Honolulu.

*New Books.*

The purchase of books has necessarily had to go slowly, but gradually the standard works on Botany, Entomology and Forestry are appearing on our shelves. Among the more important accessions received in this way during the last year may be mentioned the following:

Forestry Books.

Sargent's "Manual of the Trees of North America" and "Forest Flora of Japan"; Floras of the Northern United States and Canada, the Southern States, Mexico, New Zealand, Queensland, Fiji Islands and Guam, Snow's "Principal Species of Woods," Fernow's "Economics of Forestry," Bruncken's "North American Forests and Forestry," Newell's "Irrigation in the United States," Wilson's "Irrigation Engineering," Webber's "The Forests of Upper India," Merrill's "Rocks, Rock Weathering and Soils," Marsh's "The Earth as Modified by Human Action."

Entomological Books.

Ratzeburg's "Forst Insecten," Say's "Entomology," Zoological Record for 1904, "Insect Life (complete with index), Aldrich's "Catalogue North American Diptera," Sorauer's

"Handbuch der Pflanzenkranheiten," Signoret's "Cochenilles," Peckham's "Wasps, Social and Solitary," Kellogg's "American Insects," Wright's "The Butterflies of the West Coast," "Hours with Insects," Saunders' "Fruit Insects," Balfour's "The Agricultural Pests of India," Donavan and Westwood's "Insects of China," Donavan and Westwood's "Insects of India," Weise's "Exotic Coccinellidae."

The attention of the public has been repeatedly called to to the Library and to the opportunity for study it affords to persons interested in tropical agriculture, and gradually it is coming to be consulted. Visitors are always welcome and the members of the Board staff are glad to assist them in every way in making use of the books in the Library.

The Entomological publications are kept in cases in the rooms of that Division, facilitating the work of that staff and also increasing the shelf space in the general Library room. Arrangements have already been made for the addition of new cases in the Library room which will be appreciated as the present shelves are beginning to be crowded.

A card catalog of the Library by subject, author and series, has been started, the Entomological books being first taken up. In this connection mention may be made of the official card catalog of the Experiment Station publications, prepared by the U. S. Department of Agriculture and covering the publications of all the Experiment Stations in the United States. It now numbers over 26,000 cards, each containing a brief abstract of a bulletin or report. The cards are now being classified in a special case. When arranged the catalog will be a great help in ready reference, especially as many of the publications referred to may be found in the Library.

## ROUTINE WORK.

The routine office work of the Board has been carried on during the past year by Miss Melika Peterson and Miss Ella K. Dayton, who took Miss Peterson's place during the latter's absence, because of illness, from April 5th to October 18th, 1905. Both have given faithful and conscientious service and done much to assist the members of the staff in the work of the Board.

During the year somewhat over 100 "Board" letters have been sent out, in addition to those of the several Divisions. Of these the "Forestry" letters number about 600.

The Clerk of the Board attends to the stenographic work of the Division of Forestry and of the Veterinarian, beside typewriting various reports and other special papers. many of which are made with a number of carbon copies that they may be sent to members of different Committees. The Clerk also reports the Board meetings, keeps the books of the office—in itself no little work, as the appropriation is segregated into numerous items—and attends to other routine work.

During the year the mailing list has been reclassified and enlarged and the names typed on cards. In response to requests, the first annual report and other publications of the Board have been freely distributed, while through this office there have also been sent out the Hawaii quota of the 1903 and 1904 Yearbooks of the U. S. Department of Agriculture, received through the courtesy of the Delegate to Congress.

*Office Equipment.*

The office equipment has been bettered during the year by the addition of new units in the filing cases and by the introduction of call bells, a telephone extension, added electric lights for night meetings, etc.

Several changes have been made in the Board building. The room on the Ewa side of the hall, between the Exhibit room and the Entomologist's office, has been fitted up as the office of the Territorial Veterinarian, while certain modifications in the Entomological laboratory have added to the convenience of the staff of the Division and to the efficiency of its work. The building has been screened throughout and equipped with ventilators in each room, while on the outside a flag pole was erected in December, from which the flag is now regularly displayed during office hours.

The Exhibit of Woods and Fruits was opened to the public early in the year and has received favorable comment from many visitors. During the year many new fruits have been added to the collection, the work of properly preparing them

for exhibition being done under the direction of Mr. Alexander Craw. A record book has recently been installed in which visitors are requested to register. During November and December, the names of 46 persons were entered in this volume, but as many visitors neglect to sign, this only represents a part of those who have visited the building.

The Board room was used during 1905 for ten Board meetings; also for evening meetings by the following organizations: Entomological Society, ten times; Farmers' Institute, twice; Honolulu Improvement Committee, once. The electric lights that have recently been put in contribute much to the comfort of evening meetings and make the building a good place for such gatherings. Through these meetings the Board gets the advantage of acquainting the public with its library and work and in bringing them in touch with what the different members of the staff are doing.

The appearance of the Nursery grounds has been much improved during the year and they are now kept in good shape with the help of two prisoners, detailed by Sheriff Henry for that purpose. As was noted in my report as Superintendent of Forestry, the trees in the Nursery grounds were labelled early in the year with neat signs giving the common and scientific name of each. A new entrance driveway on the Waikiki side of the building, begun in December, will add to the convenience of the staff. A liberal use of green stain has rendered the fences, stables and laborers' quarters inconspicuous and attractive. With the completion of certain other improvements to be made in January the buildings and grounds will be put in a condition of much greater usefulness than at any time in the past.

Very respectfully,

RALPH S. HOSMER,
Librarian.

FIG. 1. OFFICE OF ENTOMOLOGIST. FIG. 2.—INSECTARY AND FUMIGATING HOUSE.

# DIVISION OF ENTOMOLOGY.

## Report of Superintendent of Entomology and Inspector.

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Honolulu, T. H. Dec. 31, 1905.

To the

Honorable Board of Commissioners of
Agriculture and Forestry,
Honolulu, T. H.

Gentlemen:—I herewith present a synopsis of the agricultural-horticultural quarantine work performed by your officials for the calendar year 1905. The value and importance of the above work can only be judged from the experience of the Islands in the past, as it is a well known and conceded fact that all the injurious insects and diseases of plants and trees are introduced species that have entered upon plants from other countries. It would be utterly impossible for such pests to enter this Territory by natural distribution of their own migration. From the isolated position we are in, if the quarantine had been instituted earlier in the history of the country, it would have remained a paradise free from such pests, for with inspection, disinfection, or fumigation, it would have been practically impossible for the vast hordes of devastating insects and diseases to have secured lodgement here.

When we take into consideration that our loss from insects alone in the United States amounts to four hundred millions of dollars annually, prineipally from imported insects, we feel that the above is an under estimate, when we consider that our own "Hawaii nei" lost in one crop (sugar) two years ago over three millions of dollars by the depredations of an imported pest. This was a serious loss for one year from such a small insect as the "cane leaf-hopper" (*Perkinsiella saccharicida*, Kirkaldy). Your Board, with the co-operation of the Ha-

waiian Sugar Planters' Association, took up the matter in the only logical way of combating pests and despatched two experts to the home of the hopper where they studied up the natural enemies of the pest and succeeded in introducing a few living specimens that were carefully bred and liberated under proper environments where they rapidly increased and spread until now they are destroying over fifty per cent of the hopper eggs. At this rate of check to them in a period of one year it is natural to surmise that this pest has reached the limit of its destructiveness, and the loss from that source will hereafter be diminished to a normal condition.

However, it is best to prevent the introduction of all vegetable eating insects, for it requires time to determine how serious they may become without their natural check, and in that time it is generally too late to try and exterminate them by artificial methods.

## AGRICULTURAL-HORTICULTURAL QUARANTINE WORK.

### SUGAR CANE PESTS.

In January a box of sugar cane arrived from Australia; upon inspection the cane was found to be infested with boring lepidopterous larvae measuring from 1/16 to 3/4 of an inch. Those worms burrow into and under the buds, destroying them for cuttings, and injuring the vitality of the cane. A number of "mealy bugs" (*Pseudococcus*) was also found under the leaves, as it was a new variety of cane, and being desirous of thoroughly disinfecting it from "bud worms," we used a strong charge of carbon-bisulphide. Evidently, however, sugar cane will not stand as strong a charge of that vapor as grape vines, or other plants or seeds requiring treatment by that method, for most of the cane was killed as well as the bud worms and "mealy bugs."

Another importation of sugar cane received from Fiji was treated with hydrocyanic acid gas before unpacking in order to destroy any insects that might have developed in coming through the tropics and liable to escape when the case was un-

packed. Each piece was inspected with the following result: One cane borer beetle and two larvae of the same; one larva of a small *Buprestid* beetle cutting a transverse tunnel slightly under the surface, also a few adults and larvae of "mealy bugs" (*Dactylopius calceolariae*).

Two packages of sugar cane cuttings came in by mail from Queensland; upon inspection the cane was found to be seriously attacked by a skin fungus, first appearing on the cane in small pustul-like proturberances, afterwards rupturing the skin from which issue the black fungus threads; besides the above fungus, strong colonies of "mealy bugs" were hidden at the base of the leaves that were in a healthy condition and breeding as if they were in a cane field. The cane and packing was burned, saving samples of each pest in glass jars containing formalin.

Another importation of sugar cane, this time from the Philippine Islands, consisted of two packages done up in bamboo. The sugar cane contained evidence of what appeared to be a *Lepidopterous* cane borer and numerous punctures made by "leaf-hoppers." We consigned cane and packages to the fire.

## COCOANUT PESTS.

In January a local schooner brought a cargo of cocoanuts, including fourteen hundred and fifteen young trees for sale, from the Island of Palmyra; upon inspection we found the trees infested with small worms destroying the leaves and differing from the cocoanut palm worm (*Omiodes blackburni*). The leaves were also infested with microscopic, light colored mites that were feeding upon the chlorophyll, giving the leaves a blotched appearance. All the trees were destroyed by fire and we sealed down all hatches and closed up all ports, doors, etc., with paper pasted over to prevent the escape of the gas; we fumigated the entire vessel with quadruple strength of hydrocyanic acid gas.

COCOANUT CRAB.

(*Birgus latro*)

FIG. 1.—Cocoanut Crab (*Birgus latro*), about 1-5 natural size (original).

On the same schooner was also imported a monster Cocoanut Crab. This is a very destructive crustacean and coming under Rule II of your regulations prohibiting its landing, we killed it by fumigation and a photograph is herewith given; it had two powerful jaws, one of which it used to crush and open cocoanuts upon which it lived. It had a spread of eighteen inches and beautifully colored, blue predominating.

ARRIVAL OF SUGAR SHIPS IN BALLAST.

Several vessels of the sugar fleet have come in with ballast. Upon inspection and before permission was granted to discharge we were assured by the Captain of each vessel that their ballast was obtained from Telegraph Hill, San Francisco; it consisted of broken rock and some sandy soil. During the discharging of the ballast it was occasionally examined without finding anything detrimental to agriculture. The material was used to fill in along the water front.

PESTS FROM FLORIDA.

Through orders from the Department of Agriculture, Washington, D. C., five packages of Mango grafts were received by a

resident of the Islands from Florida, having the following insect pests that upon a microscopic examination showed them to be still alive.

*Crysomphalus dictyospermi* in various stages of development, a fringed scale (*Asterolecanium*, sp.), also the "greedy scale," (*Aspidiotus rapax*) and a bark fungus. The owner's attention was called to the condition of the grafts and he offered no objection to their destruction by fire.

INFESTED FLORIDA ORANGE TREES.

Twelve budded orange trees covered with "chaff scale" (*Parlatoria pergandei*), also a liberal supply of *Lepidosaphes beckii* came by mail and were burned.

DANGER FROM FLORIDA ORANGE TREES.

Citrus trees from Florida or Louisiana are liable to bring with them the destructive "white fly" (*Aleyrodes citri*) that has proved such a loss to those States. This insect is closely related to scale insects, but differs, as the females, as well as the males, are winged and each has two pairs, so can spread of their own volition; on this account they are more difficult to control either with sprays or fumigation, so I would advise that no citrus trees be purchased from either State.

Two packages of semi-tropical plants by mail from Florida contained a *Pulvinaria* and *Lecanium*, which we fumigated much to the indignation of the owner, as he said that he had a letter from the nurseryman informing him that the plants were absolutely free from insect pests.

OFFICIAL CARELESSNESS.

Five large wardian cases of plants arrived in August from the Department of Agriculture, Washington, D. C., accompanied by certificates that the plants were free from insect pests and a letter to one of the owners, expressed the hope that the quarantine inspectors at Honolulu would make no

trouble for him. Naturally the owner considered that such a certificate would act as a "carte blanche" for his plants and they would require no further inspection. As this Territory is most interested in the condition of such imported stock we prefer to make our own examination and in this case we found the following injurious living insect pests. One owner was present during the inspection and personally saw that the following insects were alive:

*Coccus longulus* in various stages.

*Saissetia oleae* containing eggs.

*Pulvinaria camelicola.*

*Lepidosaphes beckii.*

*Chrysomphalus ficus* in various stages.

*Aspidiotus*, sp.

The first two named were sufficiently numerous so that no experienced inspector should have overlooked them. The entire shipment was fumigated with hydrocyanic acid gas and has been twice subsequently inspected without finding any living insects.

The sending out of such infested plants I consider nothing less than criminal, and the enormous loss sustained by the people of the country by imported insect pests should be sufficient cause for the Department of Agriculture at Washington, to have all plants entering the United States to be rigidly inspected and fumigated before propagating and distributing them broadcast over the country.

The Pacific States, I believe, are the only ones that have horticultural quarantine laws against imports, but the Federal Government should certainly see that all plants imported by its officials are freed from pests and disease.

### A DANGEROUS SHIPMENT.

Upon the arrival of the S. S. "Manchuria" from Japan, we found two boxes on the bridge containing trees; one of the

boxes was fitted up with fine brass wire-cloth ventilators through which I observed great numbers of the destructive "Gipsy moth" (*Porthetria dispar*) caterpillars. This box was not provided with a lock, so I had the door fastened with large screw nails to prevent the over inquisitiveness of any one that felt disposed to open it and thus release this terrible scourge in our midst. The other box contained growing trees from which to cut food for the caterpillars should they require it. Those trees were also seriously infested with a species of "Saw-fly" larvae that were rapidly defoliating the trees. I purchased eighteen yards of mosquito bar, with which we wrapped the trees and crate to prevent the escape of any insects that might have developed on the voyage. The Gipsy moth was unfortunately introduced into Massachusetts about thirty years ago and in recent years has cost over a million dollars annually in a vain attempt to stamp it out, but with all that outlay they have not even been able to check its spread.

## AUTHORITIES AWAKENING.

It is pleasing to note that at last the Massachusetts authorities are awakening to the fact that it is useless to attempt the extermination of that pest by artificial methods and have at last made an effort to introduce its natural enemies. This I learned by a letter from Prof. S. I. Kuwana, that he had forwarded the "Gipsy moth" caterpillars with parasites from Japan at the request of U. S. Consul Griscom.

## MANILA HEMP PLANTS.

### *Musa textilis.*

A shipment of twenty Manila "hemp banana" plants and five rubber trees came from the Department of Agriculture, Washington, D. C., and were in good condition and free from pest or disease.

FIG. 2.—Diamond-back rattler's and other snakes (original).

### *Poisonous and Other Reptiles.*

The Hawaiian Islands have always been famed for their freedom from snakes and our people and animals could wander with impunity through our valleys and over the hills and mountains. An importation arrived on the 2nd of June ex S. S. "Alameda" from California, that might have put an end to such delightful serenity. This was the arrival of three

flimsy boxes, containing fourteen large, living snakes, five of them the deadly Rattler. Under Rule II, as published in your *General Circular No. 2*, "such animals arriving in the Territory of Hawaii are ordered to be immediately destroyed or deported." In order that there should be no hitch in the proceedings, I took the precaution and telephoned to Mr. W. A. Bryan, who is Federal Inspector of wild animals. He came to the dock and after discussing the matter with Collector of Customs E. R. Stackable and Territorial Commissioners of Agriculture and Forestry, L. A. Thurston and Alfred W. Carter, he informed us that he would refuse to issue a permit to land the snakes. The reptiles were intended for exhibition and in order that there should be no question about the proceedings, the three above named gentlemen made a proposition to the importer to pay him the purchase cost of the snakes and then they would take possession of them. This was a generous act on their part in order to keep the Islands free from such a curse, but they should not have been put to that expense by the blunder of another person that should have been and was, undoubtedly, aware of the Federal and Territorial laws relating to the introduction of animals. In the destruction of the snakes we had a surprising experience. I placed the boxes of snakes in one of our fumigating chambers and applied a charge of double density of hydrocyanic acid gas and the snakes were still alive at the end of fifteen minutes, whereas, if they had been warm blooded animals they would have succumbed in a less number of seconds. They were again shut up and a quadruple charge of that deadly gas was administered and at the end of one hour and a half the fumigator was opened and several of the snakes still showed signs of life. We then immersed them in 95% of alcohol and that soon put an end to their venomous existence. A fitting death, as the same liquid—in a modified form—is considered an antidote to their deadly bite.

I wrote to the Hon. James Wilson, United States Secretary of Agriculture, Washington, D. C., giving him a full account

of the recent attempted introduction of snakes into Hawaii and the disposition of them. Other organized bodies in Honolulu also addressed Mr. Wilson upon the same subject and he issued a *Biological Survey Circular* (No. 48), the purpose of which reads as follows:

"In accordance with the authority thus conferred, and for the purpose of preventing the introduction of snakes into the Territory of Hawaii, the order issued under date of May 22, 1902 (*Circular No. 36, Biological Survey*), is hereby amended so that on and after August 1, 1905, and until further notice, no permits shall be issued for the entry of snakes, of any kind, at any port of the Hawaiian Islands.

"Shipments of snakes presented for entry will be immediately destroyed or returned to the port from which exported at the expense of the owner or agent."

This is another proof of Secretary Wilson's desire to assist us in preventing the introduction into Hawaii of undesirable pests (see pages 141-142 of your report for 1904).

## MAIL IMPORTS.

Further proof of the advisability for the inspection of even such small plants as can be sent by mail has been forcibly brought to our attention the past year, and through the kindness of Postmaster Joseph G. Pratt of Honolulu, your request for permission to inspect all packages of plants and seeds entering this Territory by mail has been favorably considered by the Postmaster General, and we have frequently intercepted the introduction of pestiferous insects and diseases as recorded in our reports to your Honorable Board, of current work, which reports are on file in this office.

Besides those already referred to in this synopsis, the following may have special interest and refresh your memory.

In December, among other packages of agricultural matter, was one containing "chives" from Philadelphia, that we found infested with larvae and pupae of the "onion fly" (*Phorbia ceparum*). This pest is a very difficult one to combat,

as like the "melon maggot," it is practically out of the reach of the usual treatment for insect pests. I called the attention of Postmaster Pratt to the condition of the contents of the packages and he immediately notified the owner by telephone, who offered no objections to our condemning the package. As we were desirous of securing perfect specimens of the "onion fly" for our cabinet collection, I turned it over to Mr. Kotinsky, who bred out the perfect insect in a glass jar in our insect-proof breeding room.

Another package by mail contained thirty-two living pupae of *Platysamia cecropia* and *P. cynthia.* I called upon the owner of the package and he wrote out a request to Mr. Pratt to turn the package over to me, which he did and they were placed where no damage to the interest of this Territory would accrue from their importation. The former is one of the largest moths, the larvae average six inches in length and are very general feeders.

## DESTRUCTION OF INFESTED CITRUS FRUITS.

During November and December various consignments of citrus fruits arrived from Japan and China, aggregating 2950 cases, that were seriously infested with injurious insects and diseases, a full detailed record of which was presented your Honorable Board at the time. The fruit and cases were all destroyed by burning. We were threatened and served with papers for law suits for damages by the importers, but under the advice of Attorney General E. C. Peters, we carried out your regulation and the laws of the Territory of Hawaii, thus preventing the further introduction of more pests and blights. The importers were granted the privilege of exporting the fruit, but as the great distance would hardly warrant this expense, it was not done. In the case of condemned fruits from the mainland this is frequently done, although we sometimes have to resort to destruction of fruits and produce from there also. One hundred and fifty orange trees infested with leaf-miners from Japan were burned, also numbers of other trees

and plants from the mainland and other parts that were infested with destructive pests or diseases.

### IMPORTATIONS.

During the year 1905 there were examined two hundred and ninety-three vessels, on which we found 104,829 packages of fruits, vegetables, plants, etc., as freight, and during the same time we had two hundred and forty-nine packages by mail, of which we have given you detailed reports. This work has been performed by my assistant, Mr. C. J. Austin, and myself; also the fumigation with hydrocyanic acid gas and carbon-bisulphide fumes, as necessary.

As mentioned in my detailed report to you we have been called upon at various times, personally and by letters, for information in relation to the depradations of insects attacking other than strictly agricultural products. However, as they directly affected Hawaii's interests we gladly gave the necessary advice and assistance.

## RECOMMENDATIONS.

### INTRODUCTION OF BENEFICIAL INSECTS.

Through the efforts of your Honorable Board several species of internal parasites and predaceous insects for the suppression of our destructive species have been introduced, and from examination we feel hopeful that they will come up to our expectations. As Mr. Kotinsky has referred to this work in detail, it will not be necessary to take this matter up further than to suggest that you bring this important work before the attention of our Terriorial Legislators, urging them to make a liberal appropriation at their next session, so as to enable you to further continue the search for such friendly assistants to our agriculturists. There is positively no danger from the intelligent introduction of such insects that prey upon injurious species, for their stomachs will no more digest vegetable matter than that of a lion's or tiger's will. Such insects, when

once introduced, are constantly working without pay in the interests of our farmers, planters, and in fact, all lovers and cultivators of trees and plants, not even exacting a portion of our crops as their part. What all this means can be gleaned from the introductory remarks or statement in this report of the enormous loss by the depredations of insect pests. It is the introduced injurious species that prove to be such formidable ones, as they are usually brought into new countries without their more highly bred, natural checks, which can generally fly away during the time occupied in the transportation of the plants. This way of fighting our insect enemies is not any longer an experimental one, but has saved millions of dollars of property, besides retaining the value of adjoining property already improved or unimproved. Not only is our farming population increased but our merchants, tradesmen and bankers, also feel the effects of the improved agricultural conditions,—so all our people are benefited by the expenditure of money in this work.

We have in Prof. Albert Koebele one of the best and most competent and successful collectors of beneficial insects in the world, so that any money appropriated for such work will be expended in the best manner, in the interest of these Islands, as his past work has fully demonstrated. As a business proposition I feel confident that our legislators will not hesitate in furnishing you with ample funds to carry out this work so successfully started.

## INTER-ISLAND INSPECTION.

Besides the foregoing suggestions, I would strongly urge your Honorable Board to bring before the Legislature the great necessity of their making provision for the payment of two additional inspectors, one to look after vessels entering the port of Hilo and the other at Kahului. As the amount of imports entering either place will not be sufficient to call for the entire time of such inspectors they can be paid for the actual time employed in such work. Your past efforts in guarding

those ports through the kindness and co-operation of the Hon. E. R. Stackable, Collector of Customs at Honolulu, allowing his deputies to act as Honorary Entomological Inspectors at the various sub-ports may have appeared as a wise economical measure. I, however, question the soundness of that system. It is possible, probably, to find one gentleman in one hundred that is a first class man and officer for Mr. Stackable, who is also by training, or by nature, a practical inspector of plants or vegetable products, and while the gentlemen that have acted for the past two years, as a side issue to their own duties cannot be even accused of having allowed any pests to have passed them. It is, however, a well known fact that certain insects that are at present causing considerable alarm among agriculturists on other than Oahu are to be found on several of our sister Islands, and in order to prevent the spread or interchange of such pests to every county of the Territory of Hawaii, I strongly urge the appointment by your Honorable Board of one or more extra officers to look after all inter-island steamers or transportation companies and give careful scrutiny of all agricultural or horticultural products. This can be done without any serious delay to any business and certainly the objects to be derived from such work will justify any expenditures you may make a thousand fold.

Respectfully submitted,

ALEXANDER CRAW,

Superintendent of Entomology and Inspector.

FIG. 1.—LABORATORY, DIVISION OF ENTOMOLOGY. FIG. 2.—METHOD OF BREEDING PARASITES.

# Report of the Assistant Entomologist.

By JACOB KOTINSKY.

Honolulu, T. H., December 31, 1905.

Mr. Alexander Craw,

Superintendent of Entomology and Inspector,
Honolulu, Hawaii.

Dear Sir:—During the year just past my attention was prin-

The drawings for the text figures in this report were made by Mr. W. E. Chambers.

ester. Two inter-island trips were made during the year and many official visits paid in and about Honolulu and other portions of Oahu.

## I. BREEDING BENEFICIAL INSECTS.

At the beginning of the present year Messrs. Koebele and Perkins were still in Australia, and before returning in April Mr. Koebele spent some time in Fiji. From these countries he continued sending beneficial insects which were cared for in this office.

### VERANIA SP.

This species of ladybird was collected in Condong, New South Wales, where it was found to be a powerful aphis enemy. A number were brought by Mr. Perkins when he came on the "Miowera;" January 13, 1905. Only two specimens survived the voyage and these succumbed without issue.

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# Report of the Assistant Entomologist.

By JACOB KOTINSKY.

Honolulu, T. H., December 31, 1905.

Mr. Alexander Craw,

Superintendent of Entomology and Inspector,
Honolulu, Hawaii.

Dear Sir:—During the year just past my attention was principally occupied with breeding and distribution of beneficial insects; breeding and study of injurious insects and their enemies; identification of insects brought or sent to the office; classification and arrangement of collections; selection and purchase of books and supplies; the usual routine of correspondence attendant upon the above, and attention to visitors. Two circulars were written and published during the year, and, beginning with September, a popular monthly contribution on timely entomological topics was made to the Forester. Two inter-island trips were made during the year and many official visits paid in and about Honolulu and other portions of Oahu.

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DUNG BEETLES.

Out of three hundred of these collected in Mittagong, New South Wales, a little over one hundred reached us alive on February 7, 1905. That very day they were released upon a cattle ranch near Honolulu. Most of these beetles were what are known as "tumble bugs," because of their habit of rolling dung into spherical pellets and carrying them down into a previously made burrow in the ground. It was hoped that if they increased in sufficient numbers they would disintegrate cattle droppings before the hornfly has had opportunity to develop in them.

Another consignment of these insects reached us on February 28, 1905, but most of these were dead and the few survivors died soon afterwards.

PARASITES OF DUNG FLIES (*Diptera*).

A large number of dung larvae and pupae was collected by Mr. Koebele in Condong, near Sydney, and reached us in good condition on February 28, 1905. A large number of parasites subsequently issued from these and two strong colonies were located on ranches on Oahu. On two occasions these were visited later, but no evidence was found to indicate that either the parasite or the dung beetle were established.

ASIATIC LADYBIRD (*Chilocorus similis*, Rossi).*

Dr. Nicholas Russel of Olaa, Hawaii, has long been one of the most intelligent and valued correspondents of the Board's Entomological Division. Recently he went to Japan. At the request of Mr. Craw, who supplied him with letters of introduction to entomologists in Japan, he undertook to introduce into the Territory what beneficial insects he may come across. On the 8th of September this office received from Dr. Russel a colony of Asiatic ladybirds. In the absence of suitable tubes the Doctor made ingenious use of ordinary lamp chimneys. These he filled with food for the ladybirds and with it placed as many pupae and adults of the ladybirds as he could find.

* Reprint from the September, 1905, "Forester and Agriculturist."

In their turn the chimneys were packed in damp moss in a box and placed in cold storage on the "Mongolia." Of the lot sent three beetles and five pupae came through in excellent condition. A few days later the pupae reached maturity and subsequently the office was in the happy possession of five strong beetles. To the writer the care of these beetles was a lively treat, as he has had two years' experience with them at the U. S. Bureau of Entomology at Washington, whither this species was introduced to check the ravages of the notorious San Jose scale and where he has had such signal success in breeding it.

The preferred hosts of this ladybird in Japan and China are what is known in the States as the "peach scale" (*Diaspis pentagona*, Targ.), with the San Jose scale (*Aspidiotus perniciosus*, Coms.) as a close second. While both of these scale insects are reported from the Territory their abiding place was not definitely known. The entomologist in charge was, therefore, obliged to resort to experiment in order to determine whether the ladybird would adapt itself to some other scale insect that occurs in abundant numbers in the vicinity of the laboratory. Naturally, only closely allied species of scale insects could be depended upon to supply the pressing want,—food for the hungry. This was fortunately found in the rose scale (*Aulacaspis rosae*, Sandb.) which the beetles readily accepted as food and breeding environment. Ere very long eggs laid by the beetles were observed and a considerable number of these was subsequently brought to full maturity, and at this writing the second generation is getting a start in Hawaii nei. A couple of weeks ago, Mr. Austin reported the presence of the San Jose scale on some peach and plum trees at Mokuleia, Oahu, and infested twigs of these were used as food in the breeding jars with good success." * The beetle has the peculiar and interesting habit of withdrawing the scale insect from beneath its scaly dome and while munching it, fill the tenancy with an egg of its own. A full report of the habits of this ladybird appears in the 1902 Year Book of the U. S. Department of Agriculture, written and illustrated by C. L. Marlatt, the entomologist who introduced it into the States.

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* See below note on the San Jose scale colony.

But let us not be misled in our hopes. While the beetle thrives on the rose scale in the laboratory, there is no telling what will be its fate when it is placed out of doors. Mr. Koebele has undoubtedly introduced the beetles into these Islands in the past, but no records are at hand to say whether they arrived in good condition and whether they were properly cared for upon arrival, nor have any specimens of the ladybirds been collected thus far. When the colony is sufficiently strong no effort will be spared to establish the insect in the Territory. Even if it does not prove a signal success it will doubtless prove useful in helping to check some scale insects, especially upon plants in yards not otherwise looked after.

"SCUTELLISTA" (*Scutellista cyanea*, Motsch).°

This is the name of a steel blue, four-transparent-winged fly which has been imported into California from South Africa where it was discovered to be an effective check against the black scale (*Saissetia oleae*, Bern.). This scale has long been one of the worst pests in the citrus and olive orchards of California, but owing to the successful introduction and effective work of Scutellista the importance of this scale as a pest has ceased. Through the courtesy of Mr. E. M. Ehrhorn, the present Horticultural Inspector at San Francisco, a colony of this interesting parasite was received by Mr. Craw on the 25th of August. Most of the arrivals were in the pupa stage and the first dozen specimens that issued was released in and about Kapiolani Park upon Hibiscus infested with *Saissetia nigra*, Nietner. This scale was resorted to as food because *S. oleae* is exceedingly scarce in Honolulu. The parasites that issued subsequently were released upon potted Hibiscus plants infested with *S. nigra*, confined in a breeding cage. Thirty days later ample evidence of the establishment of this important parasite in Honolulu was to be observed upon the confined plants, as well as those in Kapiolani Park. The evidence consisted of the characteristic exit holes in the scales, and the numerous adults flying about in the cage. The success thus attained was gratifying indeed, and particularly interesting because it was accomplished by means of another species of scale insects, and

° Reprint from October, 1905, "Forester and Agriculturist."

because the life cycle was here completed in 30 days, some 17 days less than is required in California. This rapidity of development promises faster breeding and hence more effective work against the scale. Some of the plants in the breeding cage were transferred to Kapiolani Park and replaced by others and henceforth this Division will be in position to supply the parasites wherever they are wanted.

*Hippodamia ambigua*, H. *convergens*, and *Coccinella californica*.

A strong colony of these ladybirds was received from Mr. E. M. Ehrhorn of San Francisco on December 8, 1905. For the present they are being bred in the laboratory for subsequent distribution.

SIPHANTA EGG PARASITE (*Aphanomerus pusillus*, Perk.).*

Aware of the economy of Siphanta on these Islands, Messrs. Koebele and Perkins while in Australia a year ago, were on the sharp lookout for its enemies, since the insect came to us from that country. On October 19, 1904, the "Miowera" brought among other things a tube that contained a good many egg batches of a species of Siphanta, from these gentlemen. A note of this accession appears in the November, 1904, number of the "Forester" (Vol. 1, p. 294). By the first of November, 1904, over a hundred specimens of the parasite were bred from those eggs and distributed in two Siphanta-infested centers on this Island. The parasites will be named and described ° by Mr. Perkins in a bulletin soon to be published by the Hawaiian Sugar Planters' Association Experiment Station. It is a four-winged fly of an orange yellow body and dark head, whose entire life from egg to adult, is passed within the egg of Siphanta. On the 5th of last month the writer in company of Mr. David Haughs, the Forester's assistant, visited one of these colonies and to his delight discovered there both the fly and the tell-tale holes, evidence of its work. The good ally is thus happily established upon these Islands, and if its presence achieves what is hoped for, much good shall have been accomplished. The work of its distribution is now in order; some ten colonies have

* Reprint from October, 1905, "Forester and Agriculturist."

° At the present writing the insect has been described and named as above.

been shipped to different points on this and other Islands. With the co-operation of our correspondents we hope soon to have it disseminated through all points where the Siphanta exists.

## II. DISTRIBUTION OF BENEFICIAL INSECTS.

The following insects were distributed over the given Islands in course of the year. The list is presented here principally for the sake of record.

COLONIES OF BENEFICIAL INSECTS DISTRIBUTED DURING THE YEAR.

| | Hawaii. | Maui. | Oahu. | Kauai. |
|---|---|---|---|---|
| Siphanta egg parasite (*Aphanomerus pusillus*, Perk.) | 9 | 2 | 3 | .. |
| Asiatic ladybird (*Chilocorus similis*, Rossi | 1 | .. | 2 | .. |
| *Chilocorus circumdatus*, Schon | .. | .. | 4 | .. |
| *Coccinella abdominalis*, Say | 1 | .. | .. | .. |
| *C. repanda*, Thunb | 1 | .. | 7 | .. |
| *Coccinellidae* (Misc.) | .. | 1 | .. | .. |
| *Coelophora pupillata*, Schon | 1 | 1 | 6 | .. |
| *Cryptolaemus montrouzieri*, Muls | 1 | 1 | 12 | .. |
| Siphanta pupa parasite (*Dryinid*) | .. | .. | 3 | .. |
| Dung beetle | .. | .. | 2 | .. |
| *Fulgorids* (on "Dodder") | .. | .. | 1 | .. |
| Jap. Beetle Fungus | 2 | 2 | 36 | 3 |
| *Braconid* (Horn fly parasite) | .. | .. | 2 | .. |
| Lantana insects | .. | .. | .. | 1 |
| *Leis conformis*, Boisd | .. | .. | 4 | .. |
| *Novius cardinalis*, Muls | 1 | 15 | 7 | .. |
| *Platyomus lividigaster*, Muls | 1 | 2 | 6 | .. |
| *Platyomus* sp | 1 | 1 | 1 | .. |
| *Rhizobius lophantae*, Blaisd | 1 | .. | .. | .. |
| *R. ventralis*, Erickson | 1 | 1 | 16 | .. |
| *Scutellista cyanea*, Motsch | .. | .. | 2 | .. |
| Lantana leaf bug (*Teleonemia subfasciata*, Champ.) | .. | .. | .. | 2 |
| *Thalpochares* sp | .. | .. | 1 | .. |

A total of 164 colonies, of 24 species of insects; an aggregate of some 5000 specimens.

## III. BREEDING AND STUDY OF ECONOMIC INSECTS ALREADY ESTABLISHED HERE.

In many instances the insects sent in by correspondents or collected by the office force were immature and had to be bred to maturity before their identity could be determined, since, with the exception of the "mealy-wing" or "white flies" (*Aleyrodidae*), insects could be definitely named only in the adult stage. Owing to the great abundance of parasitic insects one is not infrequently surprised by finding in the breeding jar the parasite instead of the host. In case of a parasite that confines itself to a single species of host the latter could be determined by the identity of the former. In the majority of parasites thus far bred, however, they are not confined to a single species of host, in which case, in order to determine the particular host under investigation a repetition of breeding becomes necessary. This question will appear in more tangible form in the appended paper on the horn fly parasite.

### USEFUL INSECTS.

A determined effort was made to investigate the lantana insects. This investigation is not yet complete, but a preliminary paper on these was read before the Hawaiian Stock Breeders' Association at their annual meeting on December 18, 1905, and is submitted herewith.

### PRELIMINARY NOTES ON LANTANA INSECTS IN HAWAII.

#### LANTANA SEED FLY (*Agromyzid*).

Of the lantana insects introduced into Hawaii by Mr. Albert Koebele several years ago, those that were established are now the most common lantana insects throughout these Islands. By far the most important of them, as it is also the most active and abundant, is the small black fly (Fig. 3), the maggots of which live in and destroy the seed. Favored by climatic conditions and abundance of food, and unchecked

FIG. 3.—Lantana seed fly (Agromyzid). Hair line shows natural size. (Author's illustrarion).

by its natural enemies, this fly has increased enormously since its introduction. In course of the past year it was difficult to find a lantana seed that was not either entirely destroyed or seriously damaged by this fly. Such complete destruction of lantana seed means that the plant can no longer be sown broadcast as was done formerly by mynah birds and doves. While in Makawao, Maui, last May, I was told by a farmer that owing to the absence of lantana seed the mynah birds have deserted the locality, as a result of which the Army-worm (*Heliophila unipuncta*, Haw.) was more destructive that spring than it had been for the previous twenty years. It may possibly be, however, that the drought was the principal cause of the migration. The fact remains that a stage has been reached in the fight with lantana when a field once thoroughly cleared of it may be depended upon to remain so indefinitely. We must hope now that fields cleared of lantana are not overrun by guava, which I was assured by growers of Kona, is far more difficult and expensive to eradicate. We must bear in mind, however, that there will always be times and places, when and where, after a complete extermination of lantana seed, the flies will die out for want of food, and then the seed is likely to get the start of the fly and some germinable seed will be produced before the fly has again increased sufficiently to check it. These ups and downs of host and parasite are a common phenomenon in nature and are to be expected.

But even should the lantana fly diminish in numbers for reasons just given we need have little fear of a large production of lantana seed, for we have at least three * other insects, moths and butterflies (*Lepidoptera*), which so mutilate the flower head and flowers that very little, if any seed is formed. These accomplish their task in the caterpillar stage.

LANTANA FLOWER INSECTS.

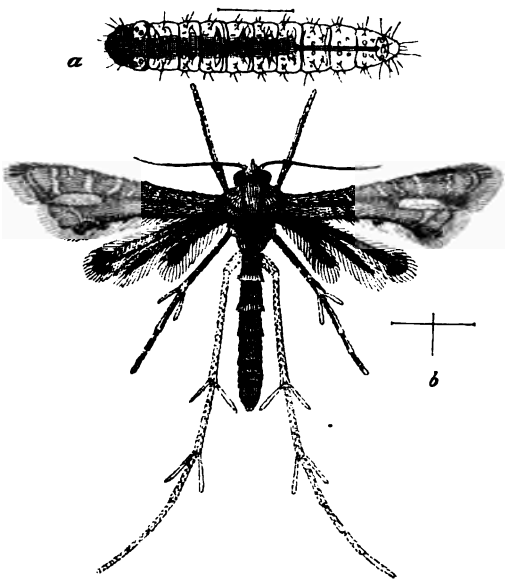


FIG. 4.—Lantana Plume-moth (*Pterophorid*): *a*, larva; *b*, adult. Hair lines show natural size. (Author's illustration).

Lantana Plume-moth (*Pterophorid*).

This is the dark brown moth (Fig. 4, *b*) about half an inch in expanse and one-half as long. It seems to lay its egg either at the base of the individual flower or slightly above. Upon hatching, in the former case, the young caterpillar excavates a tunnel under the flower; in the latter it gnaws a hole through the corrolla, attacks and destroys the pistil, then descends be-

* These may actually represent four or more species. Thus far the Tingid (*Teleonemia subfasciata*) is the only species of the introduced lantana insects that has been definitely identified.

neath the flower and continues to feed in the torus (flower-bearing head). By the time it is full grown many of the flowers are destroyed and the torus is an empty shell. Preparatory to pupation it weaves together by means of silken threads the remnants of the dead flowers and closes the entrance with the bundle thus made. It then pupates in which state it remains about two weeks, after which it emerges as a perfect moth.

The larva (Fig. 4, *a*) is opaque, greyish white, with the exception of the head, thoracic shield and true legs which are shiny brownish black. In life the head is retractile into thoracic shield; pro-legs on abdominal segments 3-6 and 9.

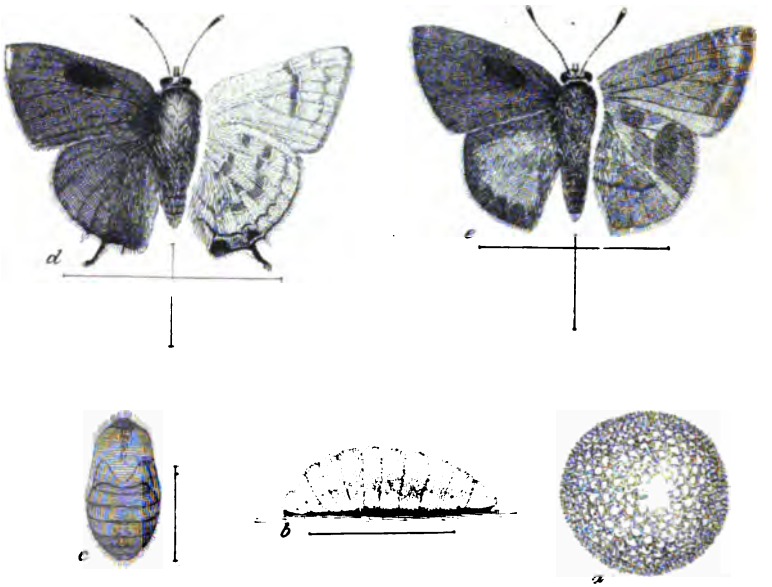


FIG. 5.—Lantana Butterflies: *a*, egg; *b*, larva; *c*, pupa; *d*, adult (bred from *a*, *b*, *c*); *e* another butterfly. Adults show marking of upper and under sides of wings. Hair lines show natural size of all, but egg which is x30. (Author's illustration.)

## Lantana Butterflies (*Lycaenidae*).

One of these is a pretty, small butterfly, with upper side of hind wings metallic blue, the rest of the insect being mottled brownish gray (Fig. 5, *e*). It lays its egg (Fig. 5, *a*) upon the young lantana flower and the subsequent caterpillar feeds upon

the flowers and young seed. The other differs somewhat in color, but its work is identical with the first. The caterpillars of both are variably green in color, fuzzy, short and stubby, varying in length from ¼ to ½ an inch when full grown, and about ½ as wide (Fig. 3 *b*) Their identify has not been ascertained, but their work is so similar in appearance that for our purpose this meagre description will answer, at least for the present. The e three caterpillars are so abundant at present that no flower is without one or both of them, and more frequently several specimens of each infest a single flower head. Especially is this true of flowers at lower elevations, so that there the chances for the production of seed are very poor indeed.

LANTANA LEAF INSECTS.

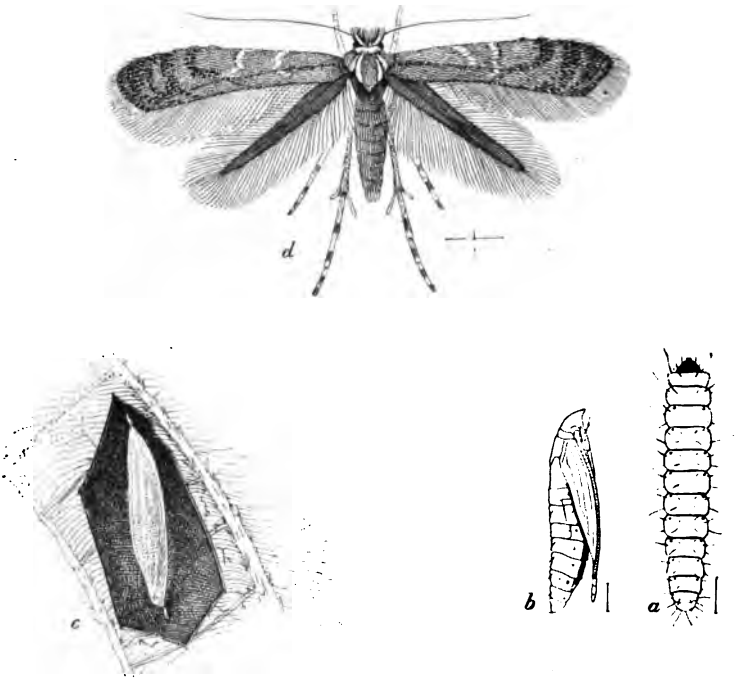


FIG. 6.—Lantana leaf miner: *a*, larva; *b*, pupa; *c*, cocoon, containing pupa, in situ; *d*, adult. Hair lines show natural size. (Author's illustration).

"Lantana Leaf-Miner."

(*Lithocolletis* sp).

This caterpillar (Fig. 6, *a*) when full grown is pale yellowish-white, with a yellow streak through the middle, representing some internal organ, doubtless the silk glands which produce the cocoon; the entire insect with the exception of the mouth parts and legs, which are brownish, is translucent and tapers slightly posteriorly; the segments are very distinct; occasionally the darker pellets of excreta are seen through the body wall. This caterpillar attains full growth within the mine and there transforms into a pupa (Fig. 6, *b*). The pupa is enclosed within a very pretty, white, longitudinally ribbed sack (Fig. 6, *c*). It seems that before commencing to build this sack the caterpillar gathers all its frass into a small space and covers it with a net-work of silk, evidently to protect itself from the effects of decay. The sack contains the inactive stage of the insect and is usually found in older, somewhat dried mines and is so conspicuous that it is not overlooked even by the layman. The tiny gilt colored, striped legged moth (Fig. 6, *d*) is the outcome of this useful miner. One of these mines (Fig. 6, *c*) is not sufficient to destroy a leaf, but as they usually occur in large numbers, up to six or more in some cases, it is inevitable that the vitality of the leaf should be materially reduced.

"Lantana Leaf Bug" (*Teleonemia subfasciata*, Champ.).

Another insect that has inflicted terrible injury upon lantana is a small Tingid bug (Fig. 7) which should be popularly known as the "lantana leaf bug." It is a true bug belonging to an order of insects (*Hemiptera-Heteroptera*) supplied with jointed beaks, capable of taking up liquid food only. Although introduced at the same time that the others were, it has not, until the past year I believe, increased to such large numbers as have the others. It may possibly be that the unusual drought of the year has been particularly favorable for this enormous increase. Large numbers of it, particularly the younger stages, occur on the under surface of leaves, and together with

FIG. 7.—Lantana leaf bug (*Teleonemia subfasciata* Champ.) Hair line shows natural size. (Author's illustration.)

the leaf miner referred to above, and the drought, they have defoliated lantana two or three times in course of the year. To all appearances, particularly on the leeward side of hills and Islands, lantana was dead. This was only an illusion, however, which was quickly removed either by careful examination of the stem or by the reappearance of foliage after heavy rains. The younger shoots of lantana were usually found dead. There is no doubt that during the last year lantana received severe injury and a quite serious set-back.

These "leaf bugs" were so abundant everywhere that it was inevitable that some of them should stray to other plants, either of their own accord, or blown by the wind. Their leisurely, deliberate mode of locomotion makes them an object of easy study. As a result of these facts many people have repeatedly observed the insect on plants other than lantana and, warned by previous experiences, have repeatedly attempted to raise the alarm of a new pest. The fact is, however, that although it does occur on plants other than lantana, it has never been observed to breed upon them or in sufficient numbers to do injury; neither has it been observed in the actual process of feeding on plants other than lantana.* So that no apprehension on the score of these insects need be entertained. Close watching, however, does no harm.

* See my note in the Hawaiian Forester and Agriculturist, Vol. II, pp. 401-2.

While the leaf insects kill the young shoots of lantana they are also, though indirectly, responsible for the periodical heavy crop of lantana flowers. It is a well known fact that plants and animals are most prolific when their chances for life are reduced. This phenomenon is accounted for by the law of perpetuation of the species, i. e., every living being feels the instinctive impulse of helping to perpetuate its kind and, when disease or want of nourishment threatens its existence it turns all of its available vitality toward reproduction. Fruit trees upon a deserted farm where they are neither fed nor otherwise attended to are known to produce heavier crops of fruit than their neighbors, upon an adjoining lot perhaps, living in opulence. In order to hasten the flowering of a plant horticulturists take advantage of this indomitable law and either root-trim those plants severely or plant them in small receptacles. To return to lantana we see that no sooner is a crop of leaves produced than it is immediately stripped. The repeated defoliation evidently so shocks the plant that it feels in danger of extermination. To save itself from such a calamity it concentrates all its available vitality upon reproduction. The plant, of course, does not reason but it does follow out the course laid down for it by nature. This overproduction of flowers is in itself therefore, an indication that the plant is suffering. As to the seed crop, I believe that our flower and seed insects will permit but little of it to mature. To all appearances lantana looks now practically doomed. Very few lantana plants are as healthy and vigorous today as they used to be.

The introduction of insects to check the spread of a plant has, to my knowledge, never before been tried anywhere in the world. Mr. Koebele is the pioneer worker in this line and judging by the marvelous results already attained, the credit to which he is entitled for what he has accomplished cannot be given him in more adequate form than by pointing out the difference between lantana on Hawaii as it was and as it is at present. He is moreover to be congratulated on the strict business-like manner in which these insects confine their work to lantana.

## Lantana Scale or "Maui Blight"

### (*Orthezia insignis*, Dougl.)

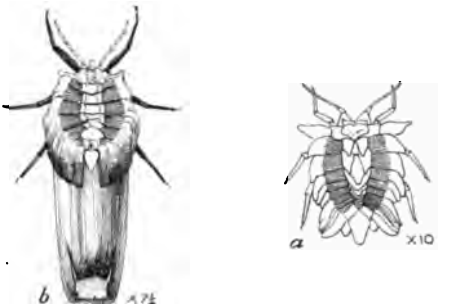


FIG. 8.—Lantana scale or "Maui Blight" (*Orthezia insignis*, Dougl.): *a*, young; *b*, adult female. Magnification indicated by figures. (Author's illustration).

This lantana enemy (Fig. 8) was NOT introduced by Mr. Koebele. In fact in an exhaustive paper published in the "1902 Reports of The Commissioner of Agriculture," he warned the people most emphatically against its distribution. Despite this warning ranchmen have been scattering lantana infested with this scale all over the Islands. Only in a few localities does it seem to spread rapidly, but, wherever it exists, it surely assists in reducing the vitality of the lantana giant. Fortunately this insect has not yet been observed in injurious numbers on any plant of economic importance, if we disregard the ornamental plants. At Wailuku, Maui, it has been observed by the writer to have practically destroyed a Gardenia, and at Ulupalakua, Maui, Mr. Eli Snyder called attention to serious infestation of *Alternanthera*, *Coleus* and *Achyranthes* by this scale bug. Where the insect will stop it is impossible to say. Its adaptability to plants other than lantana on these Islands it has shown. "A hint to the wise is sufficient."

A similar study of the horn fly and its parasites was made. The following notes on the subject were presented to the same Association.

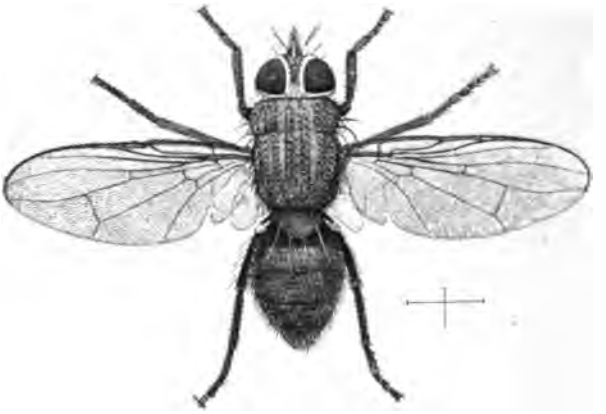

FIG. 9.—Horn fly (*Hæmatobia serrata* R. D.). Hair lines show natural size. (Author's illustration.)

From Dipterous (two-wing flies) pupae collected in horse dung at Volcano House, Hawaii, about June, 1905, Mr. F. W. Terry, of the Planters' Experiment Station Staff, bred parasites which upon subsequent examination proved to represent two species of Spalangia (*S. hirta*, Haliday, and *S. lanaiensis*, Ashm.), both recorded in the Fauna Hawaiiensis. The first of these (Fig. 10, *b*) was collected years ago in Honolulu by Rev. T. Blackburn, while the latter (Fig. 10, *a*) was found by

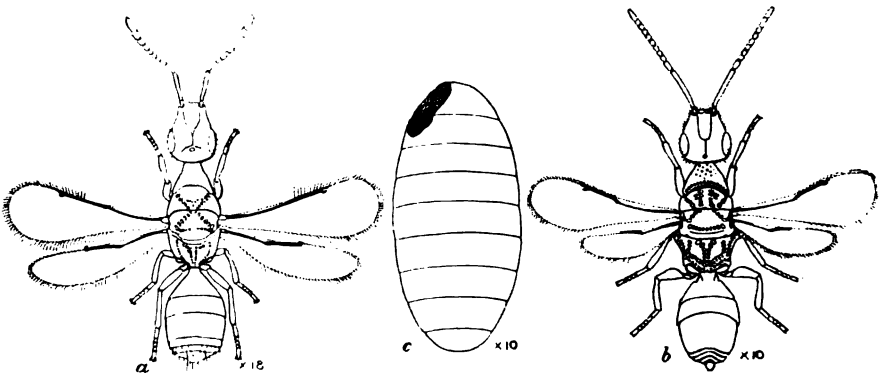


FIG. 10.—Horn fly parasites: *a*, *Spalangia lanaiensis* Ashm.; *b*, *S. hirta*, Haliday; *c*, horn fly pupa showing exit hole of parasite. x figures indicate magnification. (Author's illustration.)

Mr. R. C. L. Perkins on Lanai, and described in the Fauna as new. Mr. Terry kindly brought my attention to these parasites and offered to coöperate with me in whatever experiments I might choose to undertake, and my thanks are due him for assistance in this work. The two questions that presented themselves at this stage of the work, were (1) whether either of these parasites attacks horn fly (*Haematobia serrata*, R. D.) pupae, and if so (2), whether they occur on all these Islands; if not, they should be bred and distributed.

To determine the first point horn fly pupae were collected and placed in tubes containing active fecundated females of *S. hirta* (the other species had died out) and watched carefully. The horn fly pupae were attacked promptly and stung repeatedly, although the parasites were originally bred from pupae of the stable fly (*Stomoxys calcitrans*, Linn.). In about three or four weeks the parasites issued successfully from these pupae, thus demonstrating the possible usefulness of the parasite. Subsequent field study corroborated the laboratory work. While searching for horn fly pupae at a Palolo dairy one of the parasitic flies was observed walking about within the dung heap. It was captured and its identity with the survivors from the Volcano House established. It was also bred from pupae collected in that dairy. Horn fly pupae collected at Leilehua, Oahu, on August 1, 1905, were also found to be inhabited by *S. hirta*. Further examination disclosed that *S. lanaiensis*, the supposed native species, was bred from Dipterous pupae collected in Honolulu sometime last April. These facts demonstrated conclusively that these parasitic flies attack horn fly. The distribution and effectiveness of the parasites remained to be determined. In order to gain this information it was necessary to enlist the assistance of the ranch managers. After consulting the Secretary of the Stock Breeders' Association, a circular was sent out to all the ranch managers. Following is a copy of that letter:

LETTER TO RANCH MANAGERS.

Honolulu, October 22, 1905.

Dear Sir:—In our studies of the horn fly we have bred a parasite from its pupae collected on four ranches upon these

Islands. We are now anxious to determine the extent of distribution that useful parasite has attained. You can assist us in the determination of this important fact by collecting and mailing to us a lot of the horn fly pupae. These should be collected upon portions of the ranch differing in climate and altitude, kept separate and each parcel labeled indicating these conditions. This pupa, which is about one-twelfth of an inch wide and about twice as long, and dark brown in color, is usually to be found on the inside of the crust of droppings about three or four days old.

At the conclusion of breeding we shall be glad to report results.

Yours truly,

JACOB KOTINSKY,
Assistant Entomologist.

In response to this appeal for assistance but one man, Mr. D. T. Fleming, of the Maui Agricultural Company, sent specimens. It is true that correspondents on Kauai and Molokai also sent material, but those were replies to special requests. My thanks are due these gentlemen for the assistance rendered. Notwithstanding the meagre coöperation on the part of ranch managers, it was ascertained that at least the European horn fly parasite (*S. hirta*) exists on the five larger Islands, and that the native (?) species (*S. lanaiensis*) occurs on Hawaii, Lanai and Oahu. Moreover, about 75% of the pupae received from Molokai were parasitized. In conversation, Dr. V. A. Nörgaard, the Territorial Veterinarian, informs me that the parasite is responsible for considerable reduction of the pest at some seasons of the year, and it is evident that it is some check upon the horn fly at all times.

While on a visit to Kona last November the ranchmen there complained bitterly of the horn fly, yet when search was made for the pupae only three were found in the course of two hours This may be explained either by the particular locality or the season, or both.

Any ranch manager might determine for himself whether or not the parasite exists on his ranch. It is presumed that he is familiar with the appearance of the fly and its pupae.

If he is not, it is to his interest to make their acquaintance. Collect pupae and place in a glass jar covered with a bit of cloth held fast by string or rubber band. At the end of a week or two flies will begin to issue, and if these are small, black, *four-winged*, he may rest assured that he has the parasite. The Entomological Division of the Board of Agriculture and Forestry is at any time ready to breed, determine, and report upon any material submitted for examination.

About February, 1905, a collection of dung fly larvae and pupae were received from Mr. Albert Koebele, who collected them near Sydney, New South Wales, and about March parasites began to issue from them. Two strong colonies of these were released; one near Honolulu and the other on Leilehua. Subsequent examination of horn fly material collected at both places failed to show the presence of the parasite. The same is true of a number of dung beetles or tumble bugs sent by Mr. Albert Koebele. None have been seen since the day of their release.

### SCALE INSECT PARASITES.

The parasites affecting the numerous scale insects upon these Islands were bred extensively. In course of the coming year the writer hopes to be in a position to prepare and publish a monograph of the Coccidae on these Islands, together with a list and description of the parasites affecting them, which Mr. R. C. L. Perkins, of the Hawaiian Sugar Planters' Association Experiment Station, promises to prepare.

## IV. OFFICE AND LABORATORY WORK.

### IDENTIFICATION OF INSECTS.

This is an essential part of the office work. It is work that consumes a great deal of time, although there is little to show for it. While some insects are recognized at first sight the identification of others frequently takes hours and days of search through literature and comparison with descriptions and specimens. This is unavoidable, however, for the identity of an insect is the inevitable guide in the information to be given the applicant. We must also take stock, as it were, of

the insects occuring in the Territory in order to be posted on our enemies and friends. Frequently we are also called upon to determine the identity of an insect upon plants undergoing inspection. Great accuracy is a requisite of this work, since of two closely allied species of insects one may be already established on these Islands, and the other not yet, and, depending upon which of these infests the plant under investigation, the consignment is either admitted after fumigation or destroyed. So far as possible identifications were made in the office. With our equipment of laboratory, library and collections, this was possible in the case of many insects, particularly Coccidae. For assistance in naming insects in other groups the thanks of the office are due to Messrs. R. C. L. Perkins and G. W. Kirkaldy, of the Hawaiian Sugar Planters' Association Experiment Station; to Dr. L. O. Howard, Chief of the U. S. Bureau of Entomology, and his assistants at Washington; and to Dr. W. H. Ashmead and Mr. A. N. Caudell of the U. S. National Museum.

A number of species of Coccidae and Hymenopterous parasites, some of them new to science, were discovered in addition to the published lists. As stated before, it is hoped soon to publish a complete list of both these important groups. As related in a report to the Board, printed below, one very dangerous scale insect was discovered on Hawaii and it is believed, eradicated.

ARRANGEMENT OF COLLECTIONS.

As pointed out in last year's report this work is absolutely necessary in an entomological laboratory. As scale insects (Coccidae) are an important element in the economic insect fauna of this Territory, a special case was provided for our collection of these. A cabinet was also built to contain our main collection of insects. Whenever time permitted this work was carried on. The collection is increasing as fast as it could be taken care of and soon will be a fair representative of our economic insect fauna.

SELECTION AND PURCHASE OF BOOKS, APPARATUS AND SUPPLIES.

*Books.*

This was no easy task, as some works are scarce, and many second hand book catalogues have to be perused, carefully sifted, and much correspondence carried on before they are finally procured. A number of valuable additions to the library were made during the year. Some of these were purchased, others secured by exchange, and still others, notably an almost complete set of Tr. N. Z. Inst., were rediscoverd among the old "Government Library" books, and with the aid of the Board and the Governor deposited on our shelves.

*Apparatus and Supplies.*

First class compound and dissecting microscopes, (one of each) were purchased and used to great advantage. It is absolutely impossible to work on scale and many other insects without these apparatus. A number of minor additions to the laboratory equipment were made, which though small, were indispensable.

VISITORS.

No record of these was kept until recently and even now it seems almost impossible to have a complete record. Generally speaking the office is almost daily visited by people of the Territory and much time is consumed in giving desired information. In a way these visitors take the place of correspondence, and many people prefer to call in person.

## V. VISITS TO OTHER ISLANDS.

A necessary supplement in work as carried on by this office is personal contact with the individuals for whose benefit we are here installed. Such contact brings mutual understanding and appreciation and the co-operation of the agriculturists of the Islands, so essential for effective work. Both scientist and farmer are highly benefited by meeting in each other's

headquarters. With these objects in view a tour of the Islands by an entomologist was decided upon by the Board.

## KOHALA, HAWAII.

On May 16, 1905, I sailed for Mahukona, Hawaii. Through the courtesy of Dr. B. D. Bond, I was domiciled at his house as long as I remained in this district. The "coffee scale" (*Pulvinaria psidii*, Mask.) was found there very abundant on the under side of leaves of birdnest ferns, but most of them were pierced by as many as four or five holes, the work of two internal parasites, (*Microterys flavus*, How., and an undetermined sp.), both of which were observed in active operation. A study of the mango fruit was made but no insects were found affecting the healthy fruit. The mango flower and fruit disease was in ample evidence. So was also the ubiquitous Avocado pear scale (*Pseudococcus nipae*, Mask.). Practically all of the insect pests observed here were of a nature that could be easily controlled, but the owners of the affected plants are generally too busy with other things, so that the plants and insects are practically abandoned to fight their own battles.

One morning was spent in company of Dr. Bond in his forest composed principally of Eucalyptus and Black Wattle trees. The latter were evidently suffering from injury by Fuller's rose beetle or "Olinda bug" (*Aramigus fulleri*, Horn.), of which there were groups of immense numbers clustered on the under side of leaves and branches. In the afternoon a visit was paid to one of the homesteads in the neighborhood, but not much of a show was found in either the plant or animal life.

## LAHAINA, MAUI.

Taking the return "Kinau" I landed at Lahaina, where among others, the Lahainaluna School and the premises of the Horners' were visited. At the latter place it was delightful to find a good lime orchard in excellent condition. The care of this orchard is supervised by Mrs. Decoto, who told me that the orchard has always yielded profit despite the presence of

the "purple scale" and other citrus pests. It appears that Mr. Koebele stopped at the house some time ago and at his suggestion the lady secured a spraying outfit which she has employed to good advantage. The trees looked well trimmed and the soil between them in good state of cultivation. This was an excellent demonstration of what could be accomplished in citrus culture on these Islands when intelligence is applied.

## WAILUKU, MAUI.

That very day I took stage for Wailuku and the following day was profitably invested interviewing persons taking prominent interest in matters agricultural and in studying the insect problems of the place. The most striking feature to an entomologist about Wailuku is the blackness of the lantana. This is due to the presence of the lantana scale insect (*Orthezia insignis*, Dougl.) which was first observed there. It was interesting to note that the lantana in the vicinity of where the scale bug was first discovered is alive at present, although blackened and injured. Moreover, as noted on another page, here was my first experience on these Islands to find lantana scale in injurious numbers upon a plant other than lantana. Otherwise the insects affecting plants commonly cultivated on these Islands did not much differ from those we are accustomed to see in and about Honolulu.

## KAHULUI AND PUUNENE, MAUI.

The following morning I took train for Kahului where I had the pleasure of meeting Mr. Filler, who informed me that to his knowledge and belief no fruits or plants entered the port of Kahului without a previous inspection by the entomologist in Honolulu. The courtesy of a visit to Puunene, which I had the pleasure of making in the company of the Hon. H. P. Baldwin, was extended to me. There I was greeted by an interesting entomological problem. The Casuarina shade trees lining the streets and all the citrus trees upon the premises were dying from the effects of "cottony cushion scale" (*Icerya purchasi*, Mask.), with which they were thickly infested. This, notwithstanding the fact that only two or three

months previous to that a strong colony of Vedalia (*Novius cardinalis*) was released there. It was also noted that a Casuarina within a yard where it had evidently received good attention was practically free of the pest although the tree across the way was dying. I was forced to conclude that the prevailing drought was responsible for the state of affairs and this conclusion was confirmed when I was informed that in all probability owing to the drought no water was available for these shade trees. Of this incident you were informed at the time, as I used my letters in place of a report,—in other words, instead of noting down my observations and then copy them into report form, I wrote them down in the letter to you at the end of each convenient day.

MAKAWAO, MAUI.

By rail and hack I reached Makawao towards evening of the same day. Mr. W. O. Aiken, the honorary entomological inspector of the Board, with whom I stayed part of the time spent in Makawao, had been crippled by an accident and was, therefore, not in a position to give me much information on the imports at Kahului. In company of Mr. Jas. Lindsay of Haiku, I went up to Kailiili, where the day was very profitably spent with him and Mr. W. Hannestad, in a necessarily brief survey of insect depredations in the Koa forests. The following day was spent again in company of Mr. Lindsay in an examination of insects affecting pineapple, sisal, citrus and peach trees. The pineapple in places was found thickly infested with a pineapple scale (*Aulacaspis bromeliae*, Kern.) and with more or less mealy bug (*Pseudococcus* sp.). The trees showed evidence of neglect and perhaps the worst pest of the place is "Oi" (*Verbinaceae?*). This wiry weed constitutes a serious problem in the sisal field there. Siphanta was very abundant, especially on tender shoots of mango trees. Ripening mangoes suffered severely from fungus. Mr. D. D. Baldwin claimed to have reared a moth, the caterpillar of which was injuring mango blossoms. Unfortunately his specimens were not preserved. Here I demonstrated to satisfaction that the side of the tree and fruit exposed to the sun is least affected by the disease.

On my way to Kula I spent a few most interesting hours of the next day with Mr. E. H. Bailey. This gentleman is undoubtedly the most typical modern American farmer upon these Islands. Well equipped with an agricultural education he grows most successfully wheat, barley, spelz grass, potatoes, corn, melons, pumpkins, etc., etc. There was an excellent stand of each of these, notwithstanding the cut-worn, melon fly, potato rot, aphis and army worm that were devastating adjacent fields. The secret of his success lies, generally speaking, in a thorough knowledge and understanding of the science of agriculture. Specifically speaking, he feeds and cultivates his plants thoroughly and makes good use of appropriate insecticides. He has no difficulty, he claims, of disposing of his products on the Island of Maui to advantage, thus saving cost of distant transportation. His is beyond doubt a model farm, and this is more strongly emphasized by the strong tendency among the neighboring Japanese and Portuguese to imitate him. To an American it was a treat to see Mr. Bailey's farm. I was shown a pile of about 1700 pounds of potatoes of uniform, large size. These constituted the first half of a crop obtained from 160 pounds of potatoes planted in season.

Haleakala Ranch, by courtesy of Mr. L. von Tempsky was the next stopping place. The time spent upon this ranch was rather short, and horn fly in numbers was the only insect to attract attention. Mr. von Tempsky also complained of the ravages of aphis on corn. The following day was spent at the ranch of Mrs. Dora von Tempsky in Kula. It rained rather hard the evening of my arrival, but a trip to the native forest was made nevertheless. Fuller's rose beetle or "Olinda bug" was here in evidence, so was the "greedy scale" (*Aspidiotus rapax*, Comst.). The latter was very thick on young koa (*Acacia Koa*) and lehua, but there was also evidence that the original destroyers of the native forest are roaming cattle. The older trees when injured are immediately seized upon by various insect pests, native and introduced, which kill them in a short time, and the young trees, while they make strenuous efforts to replace the old ones by springing up in clumps here and there and everywhere, are so

mutilated and chewed up by cattle that they do not see the light of many days.

ULUPALAKUA, MAUI.

The ranch of Dr. J. H. Raymond was the next center of attraction. Along the road to this place one could not help being pained by the sight of thousands of ghosts of what were once elegant native trees. The lantana belt, which was struck in course of the descent, was interesting in that vast fields of the plant were evidently dead, killed apparently by the lantana scale. The entire area bore the characteristic black appearance. The original owner of Ulupalakua evidently lavished much money and thought upon the embellishment of the neighborhood. It was delightful to see every hill top crowned by forest trees. Perhaps the largest introduced shade trees upon these Islands grow at Ulupalakua. The numerous black wattles upon this place were found thickly plastered with cottony cushion scale, so much so, that the trees were actually dying from exhaustion. What was more surprising was the fact that not a Vedalia was to be found here, although a colony, I was informed, was released but a short time previous. Through the courtesy of Mrs. Raymond, a place some three miles away was visited, and a small leguminous plant, useful I was told as a pasture, was found infested with the same scale. The condition seemed serious enough to warrant sending a wireless asking for a shipment of a series of colonies of the ladybird. The manienie grass (*Cynodon dactylon*) was also found badly infested by an apparently new species of mealy bug.

HILO, OLAA, VOLCANO HOUSE AND KAU, HAWAII.

I reached Hilo on the last of May towards evening, and most of the next day was spent with Bro. Matthias, who had a good deal of information to give on the economic insect fauna of the district. It is perhaps needless to say that it rained most of the time spent in the metropolis of the Big Island.

The second and third of June was spent at Mountain View, principally on the estate of Dr. Russel. During these two days it rained there almost constantly so that little observation

to advantage could be made, else the locality would have received a more thorough study. The citrus plants there did not look healthy and yet the principal cause of this condition seems to have been the nature of the sub-soil which has been ascertained to contain a compound of iron (Ferrous sulphate) inimical to vegetation, as a result of which the roots instead of penetrating it remain in the surface soil. This soil is very porous and because of the great rainfall does not hold whatever plant nourishment becomes available either through natural causes or artificial application. A caterpillar, the identity of which has not been ascertained, seems to do more or less injury to the citrus blossoms. Purple scale is quite thick, although the fungus attacking it (*Sphaerostilbe coccophila*, Tul.), which has been imported from Florida, is also thriving. The citrus plants seem also damaged somewhat by snails and not a little perhaps by lichens. Here as in Kohala, every bit of arboreal or bush vegetation, dead or alive, is thickly plastered with lichens from top to bottom. Quite young plants look hoary with age because of the lichen blanket. Lichens, while not injurious directly, probably do more or less damage to plants they cover by excluding sunlight and air. Siphanta was plentiful with results similar to those given for other places.

Volcano House was the next stop. The management of the hotel maintains quite an extensive vegetable garden, the products of which are relished by their visitors. Large celery beds are a feature of this garden and much of this vegetable raised there is sold to advantage in Honolulu. The gardener complained most of cut worms and perhaps next in importance is a combination of aphis and fungus that afflicts celery. He was instructed to use poisoned bran mash against the cut worms and strong soap suds against the aphis. What seemed most remarkable at this place was the fact that ferns were observed sprouting up in cracks of lava which, I was informed by the guide, is of the 1896 flow. This would seem to indicate a very remarkable fertility of the rock.

By the courtesy of Mr. Julian Monsarrat, Kapapala Ranch was the next eighteen hour stop. What seemed to me like an oasis in the desert was the garden surrounding Mr. Mon-

sarrat's house in Kau. The Japanese beetle being the first topic, we dug about the bases of roses and were encouraged to find beetles dead with fungus in great abundance. This Mr. Monsarrat told me was the result of a colony of fungus we sent him some time previous. An undetermined caterpillar was found devouring the beet leaves. A taro patch in the vicinity was visited where the plants were suffering from aphis infesting the leaves. This aphis was not found as abundant as it seems to have been during the drought, still the young plants were quite thickly inhabited by the pest. But upon each leaf there was an average of about eight to ten Hemerobiid larvae voraciously feeding on the aphis. This was a revelation to Mr. Monsarrat and he felt fully compensated for my visit. There is apparently no lantana in Kau, but its place is taken by the scarcely less pernicious Oi. Mr. Monsarrat showed me a patch of this weed that seemed to be dying out which he thought was due to lantana insects sent him by Mr. Perkins some two years ago, but I could find no evidence of either the insects or their work. Red spider, however, was thick on the leaves which might account for the defoliation. The fungus on mango was in evidence and among the blossoms was a caterpillar of unknown identity. By stage from Pahala to Honuapo and by the "Mauna Loa" from there I reached Hookena on the evening of June 7th.

HOOKENA, HAWAII.

The night was spent with Mr. G. W. McDougall and the next morning a study of the coffee trees in his charge was made. Mr. McDougall's attention had been called by Mr. John Gasper of Napoopoo to the prevalence of a caterpillar in the coffee berry clumps. This caterpillar was found on Mr. McDougall's coffee trees in considerable numbers, though in no case was positive evidence found to show that the insect was actually injurious. No freshly nibbled spots were to be seen either upon the young twigs or the berries. On rare occasions a berry was found into which a caterpillar had burrowed, but this insect was quite different from the twig caterpillar. It is probable, therefore, that the caterpillar was feeding upon

"mealy bugs," which quite frequently seek shelter amongst the coffee berries. In addition thereto, that very useful parasite, *Chalcis obscurata*, Walk., was found literally swarming about the trees, and though it was not observed in the act of oviposition, there is no doubt but that it was there in quest of this caterpillar as host. There was absolutely no other insect upon the coffee trees to account for this abundance of a parasite about them. It was at the door of the twig caterpillar that Mr. Gaspar laid the cause for the dropping off of a large portion of the newly set berries. After ascertaining the nature of the caterpillar I am inclined to believe that the heavy loss of berries was due primarily to the lack of cultivation of the coffee fields so affected. A not unimportant cause was also the unprecedented drought of the year preceding.

NAPOOPOO, HAWAII.

Most of the day following was spent with Mr. John Gasper of Napoopoo. A survey of his coffee fields disclosed the fact that almost all of his coffee trees take care of themselves as best they can. The only attention they receive is that whatever berries they produce are picked off. Myriads of Siphanta swarmed everywhere. It is scarcely credible that they are not injurious, considering their numbers. The widespread havoc in coffee fields played by the fungus disease, for which Siphanta is held indirectly responsible, justifies strenuous efforts at checking the pest.

A mango tree was here found thickly inhabited by the black, beetle-like cockroach (*Eleutheroda dytiscoides*, Serv.). It has previously been known as destructive to Cypress and Citrus trees. Mr. Gasper, the owner of this mango, had his chickens trained to follow him whenever he approached the tree and devour the roaches as fast as they were shaken to the ground. This method seemed so efficient that it was later suggested to others complaining of depredations of this pest.

Close by the residence of Mr. Gasper is Mr. Bruner's pineapple field and cannery. The mealy bug, so common on this fruit wherever it is grown, was here found in abundance, but not enough to do material harm. The decayed spots on the fruit were found inhabited by the beetles (Staphylinid and

others) common in such places. Their injury being of a secondary nature it need not be feared. A vinegar fly (*Drosophila*, sp.) was a source of annoyance to Mr. Bruner at the mill, and he was advised to so dispose of the refuse that it dries as quickly as possible, thus destroying the breeding places for these flies.

KEALAKEKUA, AND BALANCE OF KONA, HAWAII.

The rest of the time was spent in a study of the insects on coffee, citrus and vanilla along the Government road of Kona.

The most abundant insect in all these fields was the Siphanta. The locality simply swarmed with them. Occasionally a branch of coffee was found overrun with coffee scale, though ever accompanied by that most useful little animal, the brown ladybird (*Cryptolaemus montrouzieri*). The parasites of this scale were also commonly observed. The most injurious pest in the coffee fields is fungus, beyond a doubt. Trees laden with the blackened berries of the previous crop were everywhere to be seen. I was informed that fully 25% of the coffee crop is ruined every year by this disease, and this in fields in an excellent state of cultivation.

Citrus plants were found afflicted with the usual retinue of scale bugs, including purple scale, Florida red scale, (*Chrysomplalusficus aonidum*, Linn.), acuminate lecanium (*Coccus acuminatus*, Sign), etc. As there are no commercial orchards of these trees, none of them receive proper treatment, and the results are evidenced by unkempt, scraggy trees dying from sheer exhaustion.

While Siphanta was abundant in the vanilla gardens, it did not appear particularly harmful. A species of thrips in the flowers was complained of, and, worse still, some fungus disease occurring within the vine stems seemed to give the vanilla growers some concern.

Some casual observations on lantana were made. This plant was found infested with all its known insect pests except the leaf miner and lantana scale.

HUALALAI.

At the invitation of the Forester, R. S. Hosmer, who arrived at North Kona about that time, I accompanied him up the Kona slope of Hualalai to examine the insects affecting the trees on the proposed forest reservation. It was rather wet and cloudy most of the time spent up the mountain side. A fair collection of native insects was made, but none of them were found injurious to the prevailing vegetation. Nor were any of the noble Koas met there affected in any way.

**NOVEMBER VISIT TO KONA.**

The following letter from Mr. Craw, and copy of my report, reprinted from the December (1905) "Forester," fully expose the cause of the journey and its results:

LETTER OF MR. CRAW TO ENTOMOLOGICAL COMMITTEE.

Honolulu, October 28, 1905.

Hon. W. M. Giffard,

Chairman Entomological Committee,
Board of Commissioners of
Agriculture and Forestry,

Honolulu, T. H.

Dear Sir:—Among a number of specimens from a variety of plants received from Kealakekua, Kona, on Wednesday last, we have found upon the leaves and bit of twig labelled "Giant lemon from Fiji," a number of scale insects of the species known in Ceylon as "Green bug" (*Coccus viridis*, Green).

This is the first time that the attention of any entomologist was brought to the existence of this dangerous insect upon these Islands. Mr. Green, the Government Entomologist of Ceylon, reports it as occurring there upon a large variety of plants, including Citrus, Guava, Manihot (ceara and para), and last though not least important, upon coffee, both Liberian and Arabian. In a recent monograph of the species of this genus occurring in Ceylon, Mr. Green has the following to say regarding this species:

" 'Green bug' has proved such a scourge in Ceylon, being practically responsible for the final abandonment of coffee

cultivation over the greater part of the planting districts, that a short account of its origin and ravages must be added to the bare description given above.

*Lecanium viride*, popularly termed "Green bug," first attracted attention in Ceylon in the year 1882, when it was already doing considerable damage to coffee in the Matale district. The pest rapidly extended its area, and spread through all the districts of the Central province within three years. In 1886 it completed its conquest by appearing in the Badulla district, of the Province of Uva.....

Some idea of the collapse of the coffee industry may be obtained by comparing the annual export of coffee during the period of attack. In 1881, 452,000 cwts. were shipped from Ceylon. In 1891 this figure had fallen to 88,780 cwts. While, during the past year (1902), the total scarcely exceeded 10,000 cwts."

The insect has been reported from Ceylon, Brazil, Mauritius and West Africa. Mr. Green further reports that during the rainy season about 90 per cent of this scale is destroyed by a fungus disease described by Doctor A. Zimmerman, as *Cephalosporium lecanii*. In addition he mentions three hymenopterous parasites at work upon this scale in Ceylon, but these unfortunately "have their own natural enemies which keep them in check and prevent them from increasing in sufficient numbers to cope with the pest."

Under the given circumstances it becomes evident that an immediate examination is imperative. The origin of the scale, the extent of its distribution and the parasites at work upon it in Kona require immediate investigation. In view of the fact that the pest has been discovered in the very midst of our coffee industry, it is my opinion that no time should be lost, and active measures taken to exterminate, if possible, at least to check and prevent its spread into the coffee fields.

I propose to send Mr. Kotinsky by the next steamer sailing for Hawaii, to make the necessary investigation.

Awaiting your decision in the matter, I am,

Yours respectfully,

ALEXANDER CRAW,

Supt. of Entomology and Inspector.

## REPORT OF MR. KOTINSKY ON VISIT TO KONA.*

Honolulu, T. H., November 29, 1905.

Mr. Alexander Craw,

Supt. of Entomology and Inspector of the
Board of Commissioners of
Agriculture and Forestry,
Honolulu, T. H.

Dear Sir:—In compliance with your commission of the 7th inst. wherein you direct me to proceed to Napoopoo, Hawaii, as early as possible and make a thorough examination into the origin, distribution, enemies, etc., of the "Green bug" (*Coccus viridis*, Green) recently discovered upon portions of plants coming from said locality, also to consult with growers regarding reported fungus disease upon vanilla plants in that district and render all possible assistance, I sailed for Napoopoo, Hawaii, on the noon of that very day, reaching my destination just 24 hours later. Early morning of the 14th inst. I returned from my mission and beg leave herewith to submit my report upon it:

### GREEN BUG ON LEMON TREES AT HONAUNAU, SOUTH KONA, HAWAII.

For reasons unknown some Kona residents have lately gained the impression that all vegetation there, including vanilla and coffee, the staples of the district, is suffering from what was supposed to be a single cause. All the real and imaginary damage was laid at the door of the lantana leaf bug (*Teleonemia subfasciata*, Champ.) usually referred to by local entomologists as the Tingid. In support of this theory the evidence was presented that this bug occurs upon all plants of the district and that the foliage is studded with specks which was presumed resulted from punctures by this insect. To determine this question definitely a collection of affected leaves was submitted to this office for examination. These were received on the 24th ult. and carefully studied. Among them were a couple of leaves and a bit of twig labeled "Giant lime (mistaken for lemon)

*Reprint from December, 1905, Forester and Agriculturist.

from Fiji'' thickly plastered with what we have definitely ascertained to be the above named scale insect. The author of this species reports it to have completed the destruction of the coffee industry in Ceylon in course of some 10-20 years. As but one or two of the numerous specimens received showed signs of having been parasitized and as the plants were located in the very midst of the coffee center on these Islands, and as moreover, the insect is known to infest also rubber, guava and other plants immediate action became imperative.

It was subsequently ascertained that three years ago this month a half dozen plants were imported from Fiji. While no scale was observed upon the leaves when collected for us, it was probably observed on previous occasions, but owing to its strong resemblance to immature coffee scale (*Pulvinaria psidii*, Mask.) its identity was not suspected. Other citrus plants were found growing upon the premises and it is fortunate that the Fiji lemons were considerably removed from them and surrounded by other vegetation. A careful examination of these plants revealed only two of the lot infested with green bug, the others being absolutely free from it. Some distance away was a lemon tree about twice the height of the Fiji specimens, origin unknown, quite thickly infested with both the coffee scale and green bug. A large number of the mature scales were killed by parasites, the exit of one of which was observed and the insect captured. Some material for breeding of parasites and the collection were saved, the trees themselves having been up-rooted and burned before I left the district. The third infested tree above referred to proved quite a puzzle for a while as it was suspected of having come from another resident of the district in which case Fiji, as the original source of the bug, was not altogether certain. A careful study of the vegetation on the premises of this other resident, however, dispelled the fear that the bug was generally scattered. I failed to find it there and furthermore established that the third infested plant did not come from there. With the object of ascertaining the possible distribution of the bug, all varieties of plants liable to infestation by it were examined all along some 16 miles of Government road in Kona, as well as the premises of the planters visited, but the insect was no where found.

The limited distribution of the insect may be accounted for by the probability that only a few specimens were imported originally in addition to which it was later kept in check by parasites affecting similar scales. I believe that with the destruction of those plants we have eliminated a dangerous pest and may consider ourselves fortunate in having nipped the evil in the bud.

## FUNGUS DISEASES OF VANILLA, COFFEE AND OTHER VEGETATION IN KONA.

Having solved the green bug problem I was confronted with the necessity of allaying the peoples' apprehensions as to the future of vegetation in Kona. Vanilla seems to be suffering from a mysterious enemy to elucidate which it was necessary to become familiar with the history of the plant on Hawaii. This is given here briefly.

Some 15 years ago Mr. Edwards, who was then a Vanilla grower on the Seychelles, had the misfortune of having his entire Vanilla field devastated by a fungus disease described by Massee in the Kew Bulletin for 1892 as *Calospora vanillae*. Briefly, this fungus was described as passing through three distinct stages in course of its life cycle. The first of which, known as *Hainesia*, alone lives and propagates upon living Vanilla leaves; while the subsequent two, known as *Cytispora* and *Calospora*, do so only upon dying and dead Vanilla leaves. It is the spores of the last stage that germinate upon living leaves and produce the above *Hainesia* stage. It becomes evident from these facts that if all dead and decaying Vanilla leaves be burnt the fungus would be deprived of a medium of propagation and thus be either entirely eliminated or at least reduced to insignificance. But by the time this discovery was made it seems to have been too late to save the Vanilla field in the Seychelles. In a subsequent publication Massee reports to have identified this fungus upon Vanilla, also from Antigua and New Grenada. Some two years ago Mr. R. V. Woods, who is also an extensive Vanilla grower of Kona, observed some brown discoloration within the stems of his vines, from the effects of which a number of the vines were dying. Climatic and other conditions for Vanilla growing in Kona

seem so favorable that despite the presence of this stem disease, the vine continues to grow vigorously and rapidly until the disease breaks through the stem, when the entire plant succumbs. During a recent trip to London, Mr. Woods took some of the diseased stems over to Massee, who determined the trouble as identical with the one described from the Seychelles. The cuttings for all of the Vanilla grown in Kona were originally imported by Mr. Edwards from Fiji. Before starting Vanilla in Kona, Mr. Edwards had spent some two or three months on the Fiji Vanilla plantations, and according to his statement, has observed no disease existing there upon the vines. Had the Seychelles fungus been present there, he claims he should have recognized it without difficulty. He further claims that Massee's identification of the trouble prevailing in Mr. Wood's vines is wrong, as he is quite familiar with the manifestations of the Seychelles disease and does not recognize it upon the Kona vines. Mr. L. Lewton-Brain, a pathologist of the H. S. P. A. Experiment Station, who is familiar with Vanilla diseases in the British West Indies, and who kindly examined some of the diseased Kona vines, supports Mr. Edwards in his conviction that the brown stain of the stem, while a fungus disease, is not identical with *C. vanillae.* The writer's familiarity with the natural appearance of Vanilla vines and leaves is not sufficient authoritatively either to support or oppose Mr. Edwards' apprehensions concerning the prospects of Vanila in Kona. He, however, is inclined to regard them rather exaggerated. Perhaps because of his unfortunate experience with fungus diseases upon Coffee and Vanilla in former years, and possibly also prejudiced by the alarmist reports of some of his neighbors and by occasional defective Vanilla beans produced on his estate, Mr. Edwards has since his recent return from a visit to the Coast been scrutinizing vegetation much more minutely than he probably ever did before. As a result of this scrutiny he naturally finds very few perfect leaves on any plant. Those of us who have kept an observant eye upon life in nature are aware that owing to the thousand and one vicissitudes through which every portion of a plant and animal has to go before its mission is com-

plete, very few of them pass the ordeal unscathed. No doubt some fungus or fungi are at work upon Vanilla in Kona. Considering that Vanilla has been introduced into Hawaii from practically all its other homes and that no precaution against the introduction of its disease has been taken, it would have been surprising if none had been brought in.

## RELATION OF LANTANA INSECTS TO OTHER VEGETATION.

Owing to the onslaught of the lantana insects introduced by Mr. Koebele, this plant presents a very pitiable aspect indeed, especially after a protracted drought upon the leeward side of hills and Islands. The Tingid above referred to has during the last year increased to such multitudes that beside occurring in large numbers upon each lantana leaf, is frequently observed, though in small numbers, upon vegetation in the vicinity, whither it is probably either blown by the wind or strays accidentally. Being so abundant the number of such accidental wanderings is naturally quite large. These accidents are probably as common to the lantana seed fly and the moth of the lantana leaf miner as they are with the Tingid, but the latter is an insect that moves about deliberately and does not fly away very readily, as do the other two, in consequence of which it remains longer under the observation of the layman. While the lantana seed fly undoubtedly occurs in vastly larger numbers than even the Tingid, yet the latter is much more frequently observed and is forming a stock in the layman's knowledge of insects. Under the circumstances it is natural that the Tingid should be regarded with suspicion by persons not otherwise informed. So far not one of the lantana insects introduced by Mr. Koebele has under my observation, or to my knowledge, under the observation of any of the other entomologists in Hawaii, been found to attack plants other than lantana. Even the Tingid, while it occurs quite freely on other plants, and in my belief will bear watching, has never been observed to injure other plants. At the same time there are many other causes that produce effects upon vegetation similar to those of the Tingid. I found in Kona, for example, a number of plants, particularly the leaves of the

Ti root and Peon d'Inde, used as supports to the Vanilla vines, badly infested with a species of red spider. Taro leaves were more or less infested with a species of aphis or plant lice. Citrus plants had the usual retinue of scale insects, with the purple scale at the head of the list. The coffee scale locally occurs also in considerable numbers, and finally the ubiquitous Siphanta or Torpedo bug. This last, while much less numerous than I saw it there in June, and certainly so than reported in August and September, was still present in excessive numbers upon every variety of plant. Aside from these insects there was ample evidence all around of injury by fungus diseases to a greater or lesser extent. Turning to Vanilla, all portions of the plant, including leaves, vines and pods, show quite a variety of mal-formation and discoloration. Particularly noticeable because of its abundance was a peculiar specking upon the leaves, even those that have apparently evolved but the previous day. At first glance these specks would lead one to suspect as being the result of an insect puncture, yet no insect was observed in the act of producing one, although vines were examined both during the day and by lamp light at night. The specks are brownish in color and surrounded by a translucent ring, being concave in some instances and convex in others. As many as thirty of them were counted upon a single Vanilla leaf. Hastily examined under the microscope, Dr. Cobb has found these specks usually located concentric with spiracles or breathing pores of leaves, which he suggested would indicate injury by microbes. He could, however, make no definite statement as to the nature of the parasite. In no instance was this speck observed to extend its area and its effect upon the vine is not apparent. All the other apparent defects in the Vanilla vines are evidently of a pathological or physiological nature, not attributable to insect work. Not being a specialist in fungus diseases my usefulness to Vanilla ceased at this point. As Massee states in his paper in the "Kew Bulletin," there are probably a number of diseases affecting Vanilla and nothing short of a study in the field by a plant pathologist will determine their nature and the effective remedies against them. On general principles I advised the Vanilla growers of Kona, and this

advice was sustained by Dr. Cobb and Mr. Lewton-Brain, to cut away and destroy all the affected portions of vines. To make cuttings by means of a tool, disinfected in a 10% solution of Formalin and to keep the vines covered with Bordeaux mixture, the standard universal remedy against all fungus diseases. At my suggestion Mr. Woods has sprayed his vines with this mixture some six weeks previous to my visit, and despite the daily rains the mixture was quite evident upon the vines, both upper and under surfaces when I saw them. If this application be made every two or three weeks the vines will remain completely covered by this coat of armor, proof against fungus onslaughts from without. After instructing the gentlemen in the principles involved in the preparation of this mixture, I left with them the chemicals (10 lbs. of blue stone and 10 lbs. of unslaked lime in a soldered tin) for the impending battle against the menacing fungi.

BROWN EYE SPOT (*Cercospora coffeicola*, B. & C.) AND OTHER COFFEE DISEASES IN KONA.

The brown-eye spot disease seems to extend its ravages farther and farther afield. The coffee growers estimate their loss at about 25% of their present crop owing to this pest. If this disease is altogether responsible for this terrible loss, terrible because of the present low prices on coffee, and if, as elsewhere suggested, the prevalence of this disease is due to the presence of Siphanta, also known as Torpedo-bug, we hope that by the aid of the Siphanta egg parasites, this evil will be eliminated. Among the first colonies of this parasite to be sent out went to Kona, and while it was too soon when I was there to determine whether the insect is established, we are confident that it is, and hope for good results from its work.

A number of coffee trees, often in clumps, were observed dead. Whether in consequence of this or some other disease it is hard for an entomologist to tell, as insects are not responsible for their death. The Territory is sorely in need of a plant pathologist and physiologist to clear up many of the mysterious tree-growing failures.

I may mention in this connection that the planters of Kona sought my advice with reference to the advisability of peti-

tioning the Secretary of Agriculture to detail a plant pathologist for temporary service in Hawaii until the diseases affecting principal crops here have been studied. It occurred to me as a very good idea, knowing that the U. S. Department of Agriculture occasionally does send out specialists to States and Territories in need of their advice and assistance. I merely suggested that such a petition be sent through and indorsed by the Board.

### CITRUS TREES AND THEIR TROUBLES IN KONA.

Aside from the purple and other scales common on these plants in this Territory, many of the trees in Kona seem to suffer from the fungus disease known as "die back." In course of this investigation it became clear to me that the people of this Territory are sorely in need of a pamphlet on the scale insects of citrus plants and the effective remedies against them. Such a bulletin should be given immediate consideration. So long as we have no effective enemies of such pests as the purple scale (*Lepidosaphes beckii*, Newm.) and the avocado pear scale (*Pseudococcus nipae*, Mask.) we are compelled to urge artificial remedies to check them.

### HORN FLY PUPAE.

(See page 130.)

### LANTANA SCALE OR MAUI BLIGHT.

(*Orthezia insignis*, Dougl.)

On my way down to Kailua I observed this insect in several places upon lantana. This indicates that the ranchmen disregard entirely the warning of the entomologists of this office against the distribution of this insect. So far it practically confines its attention to lantana, although on Maui, as stated elsewhere, it has been observed in injurious numbers on several ornamental plants. How soon it will attack plants of economic value it is impossible to tell, but in view of the character of the insect the attack seems a certainty.

## VI. PUBLICATIONS OF THE YEAR.

Two circulars (Circulars 1 and 2 of the Division of Entomology) were published since the last report, so was also a series of "Entomological Notes" in the "Forester," beginning with September. Some of the latter were reprinted in the body of this report. Since the "Forester" is not for gratuitous distribution, it seems advisable to reprint the remainder herewith. To give the circulars a wider distribution they are also reprinted herein.

### ENTOMOLOGICAL NOTES FROM THE DIVISION OF ENTOMOLOGY OF THE BOARD OF AGRICULTURE AND FORESTRY.

BY JACOB KOTINSKY.

SIPHANTA OR TORPEDO BUG, (*Siphanta acuta*, Walker).*

Siphanta is the generic name of the insect generally known on these Islands as torpedo bug. Being shorter and more euphonious, it is preferable to adopt the uncouth name used hitherto.

The writer is unable to ascertain how long Siphanta has been upon these Islands. At present it is known to exist upon all the principle Islands of the group. It is much more numerous in some places than in others, and where it is numerous it occurs in prodigious numbers. It is still a mooted question among observers whether or not the insect is directly injurious. Some believe it to be harmless, while others, including the writer, are of the opinion that it scarcely can be other than a pest. The insect occurs in largest numbers during the seasons when plants grow most rapidly and congregate in immense numbers upon the tender shoots and leaves of the plants attacked. How can a plant endure having its life blood, the sap, pumped out of it through innumerable punctures in its tenderest parts without suffering materially? Moreover, the honey dew produced by the insect falling upon the foliage, induces the growth of that dirty black fungus characteristic of the presence of scale bugs and hoppers upon a plant; in fact

* Reprint from "Forester and Agriculturist," October, 1905, p. 295.

the Siphanta is a close relative to our notorious sugar cane leaf-hopper, is itself a leaf-hopper in structure and habits. But be this question of directness as it may, Mr. Koebele and others are of the opinion that it is responsible to a large extent for the distribution of the brown eye-spot of coffee (*Cercospora coffeicola*, B. & C.), so common and injurious upon these Islands. This distribution Siphanta probably accomplishes in the following manner: The mouth parts of the Siphanta like those of all true bugs, are fitted for taking up food in a liquid form only—by sucking. To accomplish this the insect inserts its proboscis or beak into the plant tissues until the sap-carrying cells are reached and then the pumping process begins. If this insertion was made at the point where spores or the fruiting stage of the disease were lying about, these may be carried down into the punctures where they germinate and grow, or they adhere to the proboscis when it is withdrawn and are carried to the next puncture. Moreover, when the proboscis is withdrawn the sap begins to ooze out of the wound and the liquid drops thus exposed make a favorable place for the adhesion of the fungus spores that may be blown about by the wind or carried by insects upon their feet. The prevalence of both the disease and Siphanta in coffee fields is strong evidence of the probable truth of Mr. Koebele's theory.

## FLEAS AND DISEASE.*

That some insects are intimately connected with some of the most malignant diseases afflicting mankind is now an incontrovertible fact. Even the layman is at present aware that *Stegomyia fasciata* is the only vehicle by means of which yellow fever is transmitted, and that Anopheles is the intermediary and conveyer of malaria. In a recent investigation Dr. L. O. Howard, Chief U. S. Entomologist, has proven that flies which breed in excrement convey infection by typhoid fever. These facts have led scientists to a more thorough investigation of all human insect parasites and their relation to the diseases of man.

In an article published by C. F. Baker, of the Cuban Agri-

* Reprint from "Forester and Agriculturist, October 1905, p. 297.

cultural Experiment Station, in a recent number of "Science," he calls attention to the fact that fleas have been and still are suspected of transmitting plague and leprosy. In the case of malaria and yellow fever the medical authorities could make no satisfactory progress in their study of the relation between insect and disease before the insects were properly classified by an entomologist. This is also true of fleas; nothing short of a thorough and extensive collection and careful and systematic study of this group of insects will help to advance our knowledge of its relation to the diseases mentioned. Considering that fleas are blood sucking animals, and that they move about so dexterously and can cover a considerable distance at one leap, it will not be at all surprising if they are found to be the distributing agents of some of our most dreaded diseases. Mr. Baker has long been interested in a systematic study of this group of insects, and in the article referred to makes a call for an extensive collection of fleas. The writer will be glad to receive specimens of this insect from correspondents in the Territory and forward them to the proper authorities for study. Since leprosy is found upon these Islands, a collection of fleas from here would probably yield much valuable data on the subject. As it is not yet definitely known whether the fleas affecting man are the same species as those affecting the animals in his environment, it is well to keep separate those coming from different animals. It is advisable to secure as many specimens as possible, place them in about 50% alcohol, and label, giving host, locality, elevation, collector and date. To those who are interested in the subject it is advisable to be supplied with a pair of tweezers, some small homeopathic vials of alcohol and several rat traps, as it is especially desirable to determine the relation of the fleas affecting rats and man. As parasites usually desert their host immediately after the death of the latter, and as fleas particularly move rapidly, it is advisable to place a white cloth or sheet of paper beneath the animal and sprinkle freely with buhach. This will stupify the insects and as they drop off on the white background, they can easily be seen and picked up. The authorities promise to return reports of all specimens sent and to give credit to collectors.

## A CIRCULAR OF INFORMATION.

BY JACOB KOTINSKY.

Assistant Entomologist.

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### INTRODUCTION.

One of the features of the Hawaiian Islands is that nearly every one, whether he lives in the city or country, is in one way or another interested in plant growth. Scarcely a door yard but has its ornamental plants, shrubs and trees. Very many of the inhabitants devote much time and attention to the cultivation of various fruit trees, some for private use only, others on a commercial scale. But the days when planting and irrigation was the only attention plants required, if they were ever here, are now past and gone. Vegetation upon these Islands is now beset with many ills, not the least among which is injury by insects. Numerous species of scale insects, cut worms, the Japanese beetle, the Olinda beetle, and many other insect pests, too numerous to mention in a circular, have come to stay with us. If there is consolation in numbers we may find it in the fact that our fate is not worse than that of the rest of the world engaged in the cultivation of plants. Man, however, acknowledges no insurmountable obstacles in his way of promoting desirable plant growth. With all means available to science he gives no quarter to his enemies. He fights until the battle is won.

### WORK OF HAWAII AGAINST INJURIOUS INSECTS.

About twelve years ago the advance of the insect army upon our vegetation became so serious that the government was compelled to appeal to a scientist for assistance. The services of Prof. Albert Koebele were fortunately secured, and the war of insect extermination was earnestly begun. Relentlessly has the conflict been waged since that year, and the comparative scarcity of what were formerly pernicious pests is ample evidence of the success of the undertaking. More recently the Board of Commissioners of Agriculture and Forestry has organized a Division of Entomology to carry on the

work more effectively. With the object of drawing the attention of the people of this Territory to the work of this Division; in order to establish more intimate and frequent communication between the people suffering from insect injury and the workers in this Division from whom they may secure help, this circular has been written.

## LOCATION AND OFFICERS.

The office and laboratories of the Division of Entomology are located in the building at the Government Nursery on King Street, Honolulu. The working staff consists of the following:

Alexander Craw, *Superintendent of Entomology and Inspector.*

Albert Koebele, *Consulting Entomologist and Entomological Explorer.*

Jacob Kotinsky, *Assistant Entomologist.*

C. J. Austin, *Inspector's Assistant.*

## DUTIES OF THE STAFF.

The Entomological staff wrestles with all insect problems outside those affecting sugar cane. In general the work of the Division may be divided into four classes, as follows:

### *I. Inspection and Quarantine.*

It has long been realized that practically *all* our insect pests are of foreign origin. At one time or another in the past they have been introduced into these Islands upon various plants and fruits brought from other countries. Those insects that have found the climate suitable and food in plenty have multiplied in proportion, and in time have become our pests. We have by no means exhausted the world's supply of insects that might become dreaded citizens of our fair isles. In order to keep those possible scourges from obtaining a foothold on our shores, a strict system of inspection and quarantine has been established by the Board. Mr. Craw, assisted by Mr. Austin, meets all incoming vessels and inspects all fruit, plants, tubers, etc., for insects or diseases that they may carry.

All such plants and fruits infested with insects or fungi not known to exist on these Islands are immediately destroyed. Plants that are infested with a species of insect already established here are fumigated with hydrocyanic acid gas. This gas is used at a strength that does not injure the plants, but kills all insect life upon them. The object of killing such insects is to prevent the infusion of new blood and vigor into those pests already here.

*II. Search for and Distribution of Beneficial Insects.*

Prof. Albert Koebele has virtually saved the vegetation of this Territory from disfigurement and utter destruction by means of the numerous lady birds and other beneficial insects which he has introduced from all parts of the world in the course of the past twelve years. This is a kind of entomological work of which only the State of California and the Territory of Hawaii have made a specialty. The almost clean and healthy condition of our trees and shrubs at present, in comparison with what it was before Mr. Koebele's coming, is sufficient testimony to the good work he has done. The services of Prof. Koebele are still at the disposal of the Territory. His mission is to travel in foreign lands, search for enemies of our injurious insects, and introduce them into the Territory. Moreover, he being the "Kamaaina" of the Division, his knowledge of the Hawaiian insects is of great value to the Division and the Territory.

*III. Breeding and Distribution of Beneficial Insects.*

A good deal of the work of this laboratory consists in the breeding and distribution of useful insects. Various ladybirds and minute four-winged flies are engaged in the good work of checking the rapid increase of scale insects, plant lice and other insect pests. As neither the "good" nor the "bad" insects are at all times equally distributed over the Islands, it is the business of the Division of Entomology to supply the "good" ones wherever they are needed. For this purpose a constant supply of some of this class of insects is kept in breeding jars and cages. Others again are collected outdoors and sent to correspondents.

## *IV. Study of Injurious Insects and Methods of Controlling Them.*

Insect life, like all other forms of life, travels in a cycle. As in a cycle there is no definite beginning or end. On and on it rolls from father to son and from son to father. Full grown females produce eggs, from which hatch young, which after a certain period of growth, become mature and lay eggs in turn. The length of time consumed between any one stage in the life cycle and the same stage beginning the next cycle, as between egg and egg, varies with the species (kind) of insect, with the temperature and other climatic conditions. In the temperate zones, the active life of most living objects, plants and animals, is interrupted by the winter months. During cold weather most forms of life remain at a standstill. The number of life cycles that any one species of insects would complete in a course of a year is thus reduced. Such is not the case in a salubrious, sub-tropical climate like ours. All forms of life continue in activity the year around. No stage of the cycle is omitted; neither is any stage of it extended because of cold, though normal variation due to fluctuation in temperature and moisture is bound to take place. Thus a species of insects that on the mainland produces from one to three *broods*, as cycles are sometimes called, if established here, breeds practically continuously and produces perhaps twice as many broods. The seeming calamity is atoned for by the equally rapid growth of vegetation. Where one crop a year is raised on the continent, two and three are grown here. Naturally, the more crops we raise upon a given area in course of the year the more attention we must devote to that area; in exact proportion to the number of crops and care given to a similar area in a colder climate on the mainland.

In a new environment the behavior of insects will change. The climate, amount of food, and number of natural enemies contribute toward this behavior. As said before, practically all of our injurious insects are of foreign origin, and, except those that are also injurious in the United States, little is known about their habits. We fight injurious insects with

their natural enemies whenever these are available. But in the case of injurious insects for which the natural check has not yet been secured, we cannot know too much about their habits and life history. A complete knowledge of these facts can alone reveal to us a loophole through which we can manage to bridle their ravages by cultural or artificial means. It is with the object of discovering these loopholes that we study the habits of injurious insects. There is still much to be done in this direction.

## HOW WE HELP FARMERS AND PLANT GROWERS.

As already stated, when beneficial insects are available these are always supplied to applicants. When these are not to be had, however, we are able, in the majority of instances, to offer good advice, or prescribe efficient remedies. Thanks to the good work of Mr. Koebele we have on these Islands a good supply of most useful insects. At all time some of these are to be had in some place. Honolulu is excellent breeding ground for all of them, and we always have an eye on the places where certain species of these are to be procured, if we do not breed them in the laboratory. And thanks to the efforts of American entomologists we know of a number of standard remedies that are efficient against various insect pests. Either beneficial insects or prescriptions for remedies it is our duty to supply to our correspondents.

When our knowledge and farmers' needs warrant it we shall publish bulletins or circulars from time to time giving information on various insects or groups of insects. It is our belief that farmers ought to know enough about their insect enemies to be able to forestall serious damage by prompt and intelligent application of preventives. This kind of knowledge we hope to impart in our future publications. This, our first one, is of the nature of an introduction, and we hope will in a way prove useful to the farmer and home owner.

## HOW TO SECURE INFORMATION ABOUT INSECTS.

It is both our pleasure and duty to study all phases of insect life. The farmer and grower of ornamental plants does it only when driven by necessity, and usually after the harm is done. Naturally, he cannot be expected to know at sight whether an insect is injurious or not. Very often he mistakes the "good" for the "bad." In Hawaii especially, all plant ailment is attributed to "blight." "Blight" is a very indefinite word. An insect may be biting or sucking its food; it may attack the blossom, leaves, branches, stem, or root of the plant. Sometimes, indeed very often on these Islands, the cause of the injury may be a fungus, a true blight. In each case perhaps a different remedy is required, and *unless we see the actual or supposed culprit we cannot suggest a remedy.* Therefore, when information about insects is desired, specimens should always be brought or sent with the inquiry.

### WRITE.

We are always glad to see a farmer in our office making inquiries. But when he writes and sends us specimens, these and his letter, as well as a copy of our answer, are placed on file, and we are thus given an opportunity to keep record of his experience with the pest, and our work upon it. Moreover, the farmer can read our letter over and over again, and still keep it for future reference. Verbal advice given in the office he too frequently forgets before he reaches home. Our advice to him, therefore, is *write and send specimens.*

### HOW TO COLLECT AND SEND SPECIMENS.

It is desirable to have specimens of the injury as well as the insect that inflicts it. We prefer *living specimens* when these are procurable. In the absence of these, dead ones will help us to identify the culprit. Collect during the day or at night, with lantern in hand, depending upon whether the damage is done during the day or night. We can identify adult (mature) insects more definitely, so collect these when

possible. But any stage will do when adults are not available, and all stages would be most satisfactory. Collect and send also specimens showing the nature of the injury. Place all the specimens in a small tin can or strong wooden box and mail them to us. No air holes are necessary. Biting insects, like caterpillars, require food, and some of their food should be placed with them. Scale insects may be sent upon a bit of their food plant inclosed in a tin or strong wooden box. A few specimens are sufficient. Wrap the box neatly in a paper, tie it, and write our address upon it. Address us: DIVISION OF ENTOMOLOGY, BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY, HONOLULU, T. H. In order that we may know whom the material is from, write your own name and address in the upper left hand corner. The stamps place in the upper right hand corner.

## COOPERATION.

His time spent mostly in the field, the farmer has abundant opportunity for making observations, which may be brought to our attention only through him. These observations may sometimes be of the greatest importance, although they can be fully appreciated by an entomologist only. It is, therefore, highly desirable to both farmer and entomologist that the latter be informed of all important observations made by the former. In other words, it is to the farmer's benefit to keep in touch with the institutions directly concerned with his interests and which he helps to maintain. Farmers should make it a point to visit this office when possible, and write us when they need assistance. Send specimens, ask questions, try to learn from us all we know about insects, and tell us all you know about them.

Approved:

L. A. THURSTON, *President.*
Board of Commissioners of
Agriculture and Forestry.

Honolulu, Hawaii, April 25, 1905.

# THE JAPANESE BEETLE FUNGUS.

BY JACOB KOTINSKY.

Assistant Entomologist.

## INTRODUCTION.

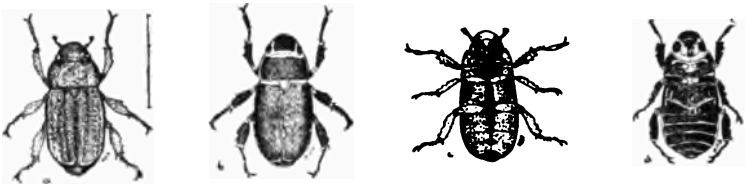

FIG. 11—Japanese beetle (*Adoretus umbrosus*, var. *tenuimaculatus* Waterh). *a*, upper side of living beetle. *b*, upper side of beetle killed by fungus. *c*, under side of *a*. *d*, under side of *b*.

Perhaps no one upon these Islands has had more extensive experience with the propagation and distribution of this useful fungus than Bro. Matthias Newell of Hilo. With the assistance of the pupils attending his classes he has been able to inoculate and distribute tens of thousands of diseased beetles through Hilo and vicinity, besides a good many that went to other localities and other Islands. He asserts with authority that the fungus has been distributed to all portions of the group. His efforts in and about Hilo have been rewarded with success which to the writer's mind is due, first, to Bro. Newell's perseverance; and secondly, to the very favorable climatic conditions, namely, the abundance of rain in Hilo. Similar success under similar conditions has been attained in other districts of the Islands. In the arid districts, however, the fungus has not been as effective as would be desirable. This is readily accounted for by the want of ample moisture without which the disease, or more correctly, the fungous parasite cannot thrive.

## STRUCTURE OF FUNGI.

As yet our knowledge of this fungus is limited. Like all fungi it is a plant of a very low order which grows in threads

(*Mycelia*) composed of elongate cells attached end to end, with occasional lateral mycelia of similar structure. After a certain period of growth some of the mycelia upon reaching favorable conditions, such as air in some, fructify. This fructification consists of the formation of a large number of minute sacks packed full of still smaller granules called spores. The spores in a way correspond to the seeds of higher plants. They are very light and extremely small, microscopical, so that when released from the enclosing sack they are blown about by the wind or transported from place to place by insects, birds and similar agencies. After lodging, favorable conditions, usually moisture and warmth, cause the spores to germinate and resume growth in form of mycelia. For nourishment fungi depend either upon living plants and animals or upon decaying vegetable and animal products. In the former instance they are classed as parasites and are regarded injurious or beneficial, depending upon whether they attack plants or animals useful to man or injurious to his interests. Thus the fungus diseases that attack our mangoes or coffee, for example, are injurious, while those destroying Syphanta or Japanese Beetles, are beneficial.

## APPEARANCE OF FUNGUS.

Just where spores must lodge upon the Japanese Beetle in order to inoculate it is not yet definitely ascertained. We must assume that the germinating spores enter the body of the beetle either through the mouth or the spiracles, or pores, by means of which the insect breathes, one of which is generally located on each side of each ring of the insect body. In a message recently received from Dr. N. A. Cobb, Plant Pathologist of the Hawaiian Sugar Planters' Association Experiment Station, who generously devotes some of his leisure moments to examine fungus material for us, he states that while he found mycelia within the general body cavity of the insect, no traces of the fungus were observed, although looked for, in the alimentary canal. This would seem to indicate that the Japanese Beetle is not infected by means of its food. The fact is that, wherever the fungus enters the insect body, it propa-

gates and grows within the body cavity until it fills it completely. This mass within looks not unlike cheese with normal butter color. The insect at that stage looks unusually clean and polished brown. When the mycelia have filled the body cavity they force their way through the thinner portions of the body wall, usually the spaces (membranes) between the segments or rings or joints and appear as a very white cottony substance. The beetle itself is usually dead long before this appearance. In from twenty-four to seventy-two hours the sporangia, or fruiting sacks, are produced. The mass then looks greyish green and is of a somewhat powdery consistency.

In course of the past several years many people of these Islands have acquired the habit of reposing considerable confidence in the effectiveness of this fungus to check the ravages of the Japanese Beetle. In point of fact, if the necessary conditions for its propagation are supplied, either naturally or artificially, some degree of success is inevitable. Fortunately the beetle shows preference for plants about door yards, where favorable conditions for the propagation of the fungus can be created with comparatively little effort. I therefore take pleasure in inserting below the instructions from the most expert authority on the subject on

## HOW TO INOCULATE JAPANESE BEETLES.

By B. M. Newell.

Take a box about six inches deep, and fill about one half with damp soil. Keep this soil moist, not muddy, by occasionally sprinkling with water. Dry soil will not work. Collect a lot of beetles and place them in this box. Be sure to feed the beetles for they must not starve. The best time to place the food in the box is during the day, because then the beetles are mostly hidden in the ground. If the box be opened in the evening they will try to escape.

Valuable plants need not be taxed for their food, for any one may have noticed that even certain weeds are eaten by them. The so-called "honohono" grass is found in many places and beetles eat it readily.

Keep the lid of the box well down. No special precaution need be taken about air holes. Keep the box in a dry, shady place.

Beetles placed in such a box and properly cared for will die of the fungus, for the fungus which destroys them is now found in all localities.

A whitish substance grows out of the joints of the dead beetles, which after a few days turn green. The substance is the fungus. When a number of beetles have developed the green fungus, mix them well with some dry or nearly dry earth or fine sand, and scatter this mixture over and around the plants attacked.

Approved:

Board of Commissioners of
Agriculture and Forestry.

L. A. THURSTON, *President.*

Honolulu, Hawaii, December 1, 1905.

# DIVISION OF ANIMAL INDUSTRY.

## Report for the Year Ending Dec. 31, 1905, with Subsequent Notes.

By Victor A. Norgaard, V. S. (Copenhagen).

*Chief of Division of Animal Industry, Bureau of Agriculture and Forestry, Territory of Hawaii.*

*Inspector U. S. Bureau of Animal Industry.*

The Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:

I beg to submit herewith my first report as Territorial Veterinarian.

My appointment to this position took effect on July 1st, 1905, and in accepting the office I reported to your honorable Board as follows:

Pursuant to your request for a statement regarding the general policy to be pursued by the Territorial Veterinarian in carrying out the law enacted by the last legislature for the suppression and eradication of infectious, contagious and communicable diseases among the live stock in this Territory, I beg to submit the following:

From personal observation during the past four months, in connection with information obtained from practicing veterinarians, stock breeders, ranch men and others, I have come to the conclusion that the greatest source of loss to live stock, direct or indirect, may be traced to three diseases,—glanders among horses and mules, tuberculosis in cattle, and scabies in

sheep. None of these diseases is indigenous to the Islands, but have been brought here by stock introduced for various purposes. The first step in suppressing them would therefore seem to be to cut off the further source of infection by means of effective regulations governing the importation of live stock, and the enforcement of the same.

*Mallein Test for Glanders.*—Glanders though frequently insidious in its course and difficult or impossible to detect on physical examination can be guarded against so effectively that the possibility of further introductions of the infection through importations should be practically impossible; and the means to this end, the mallein test, has been accepted over nearly the entire civilized world as the only remedy for the successful and economic suppression of this disease.

As California is among the States where glanders prevails to a considerable extent, and as nearly all the horses and mules imported into this Territory come from, or at least through California, it is not surprising to find that glanders heads the list among the sources of loss to live stock in the Islands. A rigid enforcement of the testing with mallein of all horse stock to be brought here is therefore necessary, but due consideration should be given to avoid causing unnecessary inconvenience, delay or expense to the owners, importers or consignees. Arrangements should be made with one or more reputable veterinarians on the Coast whose certificate of mallein test would be acceptable to your Board, and all importers of horse stock should be required to submit their animals to them for testing; all horses and mules arriving here without such certificate should be taken immediately to the Territorial quarantine station and kept there until tested, all expenses to be paid by the owner. It might be claimed by the importer that in case he gathered a shipment of horses and mules in San Francisco and had them tested there, he would, if one or more should react, have no recourse against the former owner who might live a hundred miles away. Such, however, would only be the case when the purchase was made from an irresponsible party. At any rate the animal would be a dead loss, including freight and other expenses, if shipped to this Territory and when tested here were found to react. Only a few months ago an importation of mules arrived here from San Francisco

with acute glanders among them. Two of these animals were shot on board the ship and the remaining ones taken to the quarantine station where they were kept under observation for six weeks. The loss and expense to the owners by far exceeded the cost of any preventive measures which might have been taken with this and many succeeding shipments.

Experience alone will show which of the two methods, the testing before shipment or after the arrival here will prove the most effective, and to the owners, the least expensive. In case the testing before shipment should prove satisfactory to all concerned a regulation by your Board prohibiting the landing of horse stock unaccompanied by certificates of mallein test should prove effective. In any case, it will be necessary to provide the present quarantine station with facilities for the testing of stock with either mallein or tuberculin.

*Prevalence of Glanders.*—The second measure to be considered is the suppression of glanders among the horse stock now in this Territory and the prevention of its spread from one locality to another. That glanders prevails among the horses and mules of Honolulu and vicinity to an alarming extent cannot be doubted. During the past four months fourteen typically reacting cases have been placed in temporary quarantine some distance outside of the city limits and a number of typical cases have been destroyed, making a total which few of the other States or Territories of the Union can boast in a whole year.

Considering the practically incurable nature of the disease, the danger of human beings becoming infected (in which case it invariably proves fatal) and the almost unfailing certainty with which it spreads from animal to animal when once introduced into a stable where ordinary sanitary measures are neglected, it would seem highly advisable that a proclamation by your Board be promulgated at an early date, describing the nature of the disease, the danger in handling the affected animals, and requesting all owners of horse stock to give special attention to the appearance and condition of their animals, with special regard to the symptoms of glanders, (discharge from one or both nostrils, swelling of the glands under the jaw and more rarely the formation of ulcers on various parts of the body and legs), and in

case anything suspicious is observed, to call in their veterinarian and have him examine the animals carefully.

*Watering Troughs and Hitching Posts.*—Special warning should be given against the use of public watering troughs and hitching posts, as the infection is frequently transmitted by means of these when contaminated by the discharge from the nostrils of affected animals.

Whenever the presence of glanders is suspected on any of the other Islands, or on the Island of Oahu outside of Honolulu, it should be the duty of the Territorial Veterinarian, when so requested, to visit the infected locality in order to determine the presence or absence of the disease and to take such measures as he may deem necessary for its suppression—the owner, in sending for the veterinarian, agreeing to carry out his instructions and paying the necessary expenses connected therewith.

*Tuberculin Test for Tuberculosis.*—What has been said above in regard to the importation of horse stock should also apply to cattle imported for breeding or dairy purposes as far as tuberculosis is concerned. A certificate of health, including the tuberculin test, should be obtained in the same manner before shipment to the Territory, or else be obtained through the office of the Territorial Veterinarian immediately after landing here. There is considerable tuberculosis among the dairy stock of Honolulu, and there is no reason why all the owners of stables which have license to sell milk, should not be able to produce a clean certificate of health. The infectiousness of milk from cows reacting to the tuberculin test is well established and this constant danger of infection to human beings should be removed.

A proclamation regarding the importation of cattle for breeding and dairy purposes should be prepared and put into effect at once. In regard to the testing of cows already here it would, in my opinion, be well to solicit the coöperation of the local Board of Health before any further steps are taken.

*Scabies in Sheep.*—Scabies in sheep prevails to a certain extent in the Territory, especially on the Islands of Molokai and Lanai. Effective measures have been taken on the former Island for its eradication, but it may become necessary to issue regulations to

prevent the spread of the disease from Island to Island by exchange or sale of rams and other breeding stock.

*The Horn Fly Spreads Scabies.*—There is furthermore a complication here which renders the ordinary treatment for sheep scab ineffective in producing a cure, and that is the horn fly. In no other places have I known the horn fly to attack sheep in the manner they do here. When the scab mite has caused the typical bare spots, the horn fly attacks these and by continuous irritation causes a raw sore which shows no tendency to heal but gradually increases in size. This condition naturally causes loss of flesh, prevents the development of the young animals and renders the pelts worthless. I have seen on one ranch not less than 6,000 sheep affected in this manner, and I believe that thousands of dollars are lost annually to the breeders on that account. The condition requires investigation as to the further life history of the horn fly, whether it has adapted itself to the use of sheep manure as a depository for its eggs, or whether the separation of sheep and cattle, which are now in nearly all cases running together, would be effective in protecting the sheep.

*Protection From Texas Fever.*—Of other diseases which will require the attention of the newly established Division of Animal Industry might be named Texas fever. Upon my arrival in the Territory I found that no protection was afforded the cattle industry here from the introduction of ticks by imported cattle. Under favorable circumstances the introduction of a single tick might have put a stop to cattle raising here for years. I immediately called the attention of the U. S. Bureau of Animal Industry to this fact and was assured by return mail that an order prohibiting the transportation of cattle from below the Texas fever line to the Islands would be promulagted at once.

transportation of cattle from below the Texas fever line to the Islands would be promulgated at once.

I am informed that a disease commonly known as red water exists at certain seasons in various parts of the Islands, but have so far failed to come across any case. When an opportunity presents itself this disease should be investigated.

*Big Head Among Horses.*—On the Island of Maui there prevails at the present time an epidemic of osteoporosis (big head) among the horses in certain localities. A number of them have died and others are affected. The disease is supposed not to be transmissible, but to be due to a common cause. Its true nature is unknown and whenever possible, attention should be given to its investigation. This, however, would require the facilities of a completely equipped pathological and bacteriological laboratory, and until that is forthcoming investigations of this nature must be deferred.

*Cancer Among Cattle.*—Another disease which I have never met with before is the appearance of extensive cancerous growths on the back of cattle. Three cases were observed on Maui. The neoplasms had a diameter of eight to ten inches, extending three to four inches above the surface of the skin and presented the general appearance of an ulcerating carcinoma, somewhat resembling actinomycosis. Though in good condition as to flesh, the animals, probably worth from $40 to $50 apiece, were worthless, unless a cure could be effected. Experiments are now being made along the regular lines of treatment for superficial cancer and for actinomycosis, but in case the disease should assume an epidemic nature, a fuller investigation must be made. There, again, laboratory facilities will be required.

*Liver Fluke in Cattle.*—By means of circular letters an inquiry into the distribution or prevalence of the liver fluke should be made, and certain locations selected for experiments with the eradication of the intermediary host of this parasite, a small snail (Limnaea oahuensis) by the introduction of the German carp. Good results are said to have been obtained along the Columbia intermediary host of this parasite, a small snail (Limnaea oahuensis) by the introduction of the German carp. Good results are said to have been obtained along the Columbia river through this means.

The fluke disease seems to be of considerable economic importance in certain localities on a number of the Islands and any measure of relief should be welcomed by the cattle raisers in the infected districts. As the method appears to be inexpensive, it no doubt will only be necessary to call attention

thereto in order to obtain the necessary coöperation for carrying out the experiments.

*Hog Raising Should Be Encouraged.*—I would finally call attention to the very neglected condition of two very important branches of the live stock industry of the Islands. Hog raising for various reasons is not carried on to the extent which the great demand for fresh pork and the very high prices paid for live hogs would seem to warrant. Hog cholera has been known to occur here, but this can hardly be the reason alone. The high price of grain and feed stuffs is easily offset by the great demand for the pork product. Still there are not hogs enough raised in the Islands to supply the Honolulu market alone. This condition should be inquired into and by comparison with sections of the southern portion of the United States where the natural and agricultural resources resemble those obtaining here, it might be possible to devise means for the encouragement of the production of pork and the discontinuation of its importation from the mainland.

*The Poultry Industry.*—The same applies to the poultry industry. There is probably considerable disease, especially what is called sorehead, among the chickens, but the same disease exists nearly all over the mainland where poultry raising forms a very important source of revenue. No doubt other factors are at work and efforts should be made to encourage the habitual sending of information as well as inquiries to the office of the Territorial Veterinarian, on all subjects pertaining to poultry, healthy or diseased. Such information, when carefully tabulated, would gradually furnish statistics on which reforms in breeding, feeding and sanitary measures might be based, and I believe that the poultry raisers in general would appreciate any effort on the part of your Board to assist them in making the industry a success.

*General Freedom From Disease.*—In conclusion, I would say that my observations, though limited both as to space and time, nevertheless indicate that this Territory is singularly free from most of the infectious and contagious diseases which cause such

heavy losses annually on the mainland, as well as in the rest of the civilized world, as for instance Texas fever, blackleg, anthrax, rabies and many others; and that the principal duty of the Territorial Veterinarian should be to prevent the introduction of any of the diseases not already here and in the meantime devise means and measures for the eradication of those which have gained a foothold in the Territory. If he succeeds in this the live stock industry of the Islands, though still in its infancy, will undoubtedly respond to the effects of a perfect climate and a rich soil and prove itself second only among the resources of the country.

Very respectfully,

VICTOR A. NORGAARD,
Territorial Veterinarian.

The policy outlined in the above letter has been closely followed during the past year. Two regulations governing the importation of live stock into the Territory and one aiming at the eradication of glanders within the Territory have been issued and are herewith appended.

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RULES RELATING TO ANIMAL INDUSTRY, PROMULGATED BY THE BOARD, WITH THE APPROVAL OF THE GOVERNOR, DURING 1905.—APPROVED SEPT. 11, 1905.

*"Rule 1.—Inspection of Imported Live Stock.*

"In order to prevent the introduction into this Territory of infectious, contagious and communicable diseases among live stock and other animals, local managers or agents of Steamship and Navigation lines or the commanding officer of any ship shall notify the Territorial Veterinarian or the local Live Stock Inspector immediately upon the arrival of any ship, of the presence on board, if any, of live domestic animals, including poultry and dogs, when same is intended to be landed in this Territory, and shall upon arrival of any ship furnish the

inspecting officer with a list of the number and kind of animals taken on board from any port outside of this Territory, the number and kind destined for the Territory, the names of the owners or consignees, and a report as to the condition of health and cases of sickness or death among the animals while on board.

"If necessary to remove such animals before the arrival of the inspector they must be confined on the pier in such a manner as to facilitate inspection, but should in no case be turned loose on the pier. Hogs and sheep shall be confined in temporary pens. Cattle and horses shall be tied on the pier. No animal of any description shall be allowed to leave the pier until the Territorial Veterinarian or local Live Stock Inspector has issued a certificate of health permitting the landing of the animal or animals in question.

"In no case shall the removal of live animals from the ship for inspection or other purposes, constitute a landing until a certificate of health for such animals has been issued.

"Until further notice the ports of Honolulu, Oahu, and Hilo, Hawaii, shall constitute the only ports of entry for live stock and other animals for this Territory.

"Any violation of this regulation is a misdemeanor.

"This regulation shall take effect at once."

*"Rule 2.—Inspection and Testing of Imported Live Stock for Glanders and Tuberculosis.*

"In order to prevent the further introduction of glanders and farcy into this Territory, it is hereby ordered that:

"No horse stock, (including mules and asses), shall be admitted to the Territory unless accompanied by a certificate of health showing that the animal or animals in question have been submitted to the mallein test and found to be free from glanders. Said test must be made and certificate issued by a competent veterinarian whose name appears upon the list of graduates from a recognized veterinary college and whose professional standing is satisfactory to this Board. The test must be made according to the rules of the Territorial Veteri-

narian and recorded on blanks furnished by him for this purpose.

"If such animals shall not have been tested before shipment they shall upon arrival in this Territory be placed in quarantine and held there until mallein tested under the supervision of the Territorial Veterinarian or the local Live Stock Inspector, and at the expense of the owner.

"Any person contemplating the importation of horse stock to this Territory shall notify the Territorial Veterinarian or the local Live Stock Inspector and obtain from him the necessary blanks and instructions.

"In order to prevent the further introduction of tuberculosis in cattle it is hereby ordered, that:

"No cattle above the age of six months shall be admitted to the Territory unless accompanied by a certificate of health showing that the animal or animals have been submitted to the tuberculin test and found to be free from tuberculosis. The said test must be made under the same condition as those governing the importation of horse stock and be recorded on blanks furnished by the Territorial Veterinarian. If unaccompanied by such certificate the animals shall be tested upon arrival in the same manner as prescribed for horse stock.

"If any horse stock shall be found by the Territorial Veterinarian or the local Live Stock Inspector, upon arrival in the Territory, to be infected with glanders or any cattle to be infected with tuberculosis, the same shall be immediately destroyed and the carcass disposed of at the expense of the owner, under the supervision of the Territorial Veterinarian or the Local Live Stock Inspector.

"Any vioation of this regulation is a misdemeanor.

"This regulation shall take effect at once."

*"Rule 3.—Concerning Glandered Horse Stock in the Territory.*

"It having been brought to the notice of this Board that a contagious disease known as glanders and farcy prevails among the horse stock in various portions of this Territory; therefore, in case any animal shows symptoms of glanders, the owner or person having charge of the same, or any person

having reason to believe or to suspect that an animal has glanders shall immediately notify the Territorial Veterinarian or the local Live Stock Inspector.

"If the Territorial Veterinarian or the local Live Stock Inspector decides that there is reason to believe an animal is suffering from glanders he shall at once isolate the suspected animal or animals and either submit them to the mallein test or remove them to quarantine, where they shall be kept under observation until the nature of the disease can be definitely established.

"All animals which, upon examination by the Territorial Veterinarian or the local Live Stock Inspector, are found to exhibit definite symptoms of glanders shall be destroyed and the carcass disposed of under the supervision of one of the above-mentioned officers.

"All other animals which have been exposed to the infection by being in the same stall, yard or premises, or which in any way have come in contact with an affected animal, shall be quarantined for such period as shall be required by the Territorial Veterinarian or the local Live Stock Inspector, or shall be submitted to the mallein test.

"The premises where affected animals have been kept shall be disinfected under the supervision of the Territorial Veterinarian or the local Live Stock Inspector.

"All expenses in connection with the examination, testing, destroying and disposing of affected animals, as well as quarantine and disinfection, shall be paid by the owner.

"Any violation of this regulation is a misdemeanor.

"This regulation shall take effect at once."

APPOINTMENT OF INSPECTOR AT SAN FRANCISCO.

Simultaneous with the promulgation of these rules your honorable Board appointed as local Live Stock Inspector for the port of San Francisco, Dr. Wm. F. Egan, of 1115 Golden Gate Avenue, San Francisco, California, and from that date the mallein test for horse stock and the tuberculin test for cattle have been insisted on before the admission to the Territory of such animals.

For the port of Hilo, Hawaii, Dr. Harold B. Elliot was appointed inspector.

Under these rules there have been admitted to the Territory up to the present writing (April 30, 1906) the following live stock:

| | | |
|---|---|---|
| Horses | 56 | head |
| Cattle | 96 | " |
| Mules | 245 | " |
| Swine | 2132 | " |
| Dogs | 13 | " |
| Sheep | 63 | " |
| Poultry | 113 | crates |

GLANDERED MULES IMPORTED.

In spite of these precautions glanders appeared among a shipment of mules, one case developing shortly after their arrival here and before the animal in question had had time or opportunity to become infected here. This mule was destroyed and the remaining animals, ten head, were retested. The rest of the same shipment, twenty head, had been sold to various plantations, the managers of which were immediately notified to keep them under observation for such a period of time as was deemed necessary to make sure that none of them were infected. No more cases occurred, but it should be mentioned that Dr. Egan, who tested this shipment of mules before they left San Francisco, refused to issue permits for one of them and that the animal in question was not shipped. The mule which subsequently developed the disease after arrival here was undoubtedly infected at the time of shipment from San Francisco, but had not developed the disease sufficiently to cause a reaction to the mallein test. While these circumstances would indicate that the test is not infallible the fact remains that it is the best remedy known in taking measures to prevent the introduction of glanders, and that much valuable information can be gained by the conscientious employment thereof.

## SAN FRANCISCO TEST OPTIONAL.

It should be further borne in mind that the importers of horse stock are not compelled by the regulation pertaining thereto, to have their animals tested previous to shipment. They may bring them here without inspection or testing, but in doing so they take the chance of having the disease develop among them on ship-board or else finding them infected when submitted to the test after arriving here. In either case the loss, direct or indirect, is likely to exceed by far that which would have resulted if the disease had been discovered before shipment.

## CATTLE IMPORTATIONS.

The cattle which have arrived here have been about equally divided between dairy cows for the Honolulu market and breeding stock for various ranches. The latter have invariably been accompanied by certificates of tuberculin test while most of the dairy cows have been tested here. In only two cases did the inspector at San Francisco refuse to issue certificates of health, thereby preventing the shipment of two bulls and the subsequent loss of the same.

In conclusion I am pleased to state that in inspecting and testing imported live stock I have met with unfailing courtesy from all agents and officers of the various steamships and navigation lines, and that the owners and consignees of all such stock have rendered every assistance possible in carrying out the regulations governing these importations.

## NOTICE CONCERNING GLANDERS.

In order to facilitate the discovery and apprehension of cases of glanders the following notice was published three times in all of the papers of the Territory:

## BOARD OF AGRICUTURE AND FORESTRY.

Office of Territorial Veterinarian,

Honolulu, September 12, 1905.

"All owners of horse stock in this Territory should carefully and regularly examine their animals to ascertain if they exhibit any of the symptoms of glanders or farcy, as follows:

### DISCHARGE FROM THE NOSE.

"This condition occurs in a number of diseases, as for instance catarrh of the nose and strangles (distemper, epizootic), but in glanders it is usually quite characteristic. In mild cases it is not very abundant but is thick and quite sticky, of a transparent whitish color, somewhat resembling the white of an egg. This sticky discharge adheres to the margin of the nostrils, forming tough brownish scales and crusts. The discharge does not necessarily sink when dropped in water, as is popularly believed.

"The most characteristic symptoms of glanders is the presence of ulcers in the nose, usually on the partition between the nasal chambers. These ulcers are not always plainly in sight, but may be brought into view by holding the nostrils well open and turning the nose toward the sun. They vary in size from ⅛ to ¼ inch in diameter up to one to two inches, and may become confluent and form large patches, always with ragged irregular edges. The ulcers may heal and leave depressed wrinkled scars. The amount of discharge from the nose depends upon the extent of the ulcerations; when small the discharge is scant and when more extensive it becomes more abundant. Frequently the discharge and ulcers occur only on one side. There is nearly always a swelling of the glands between the branches of the lower jaw, but not to the same extent as in strangles, and they rarely suppurate or break open.

"The type of glanders known as farcy consists in a specific inflammation of the lymph vessels and glands of the skin and may occur on any part of the body or limbs.

"The glands become swollen, forming the so-called farcy buds, and often occurring as a chain of nodules along the en-

larged lymph vessels. The nodules break open and discharge a yellowish white, sticky pus, forming crusts similar to those seen around the nostrils. The abscesses may heal up and new ones form in the same vicinity or on more distant parts of the body.

"The disease may be either chronic or acute in its course and the chronic form may at any time become acute. Mules and asses almost invariably develop the acute form, while in horses either form may be seen. Want of feed and over-work frequently causes latent glanders in the horse to become acute.

"The disease is often accompanied by a short, dry, hacking cough and a tendency to sudden swelling of one of the legs, especially the hind legs.

"In a large number of cases of glanders the symptoms are very slight even though the animals may have been affected for months or even years, and herein lies the great danger of the spread of the disease to other animals or to man.

"In the course of a few days the Territorial Veterinarian will have the distribution copies of Bureau of Animal Industry Circular No. 78 entitled 'Glanders and Farcy' and which gives a detailed description of the history, nature, symptoms, diagnosis and prevention of the disease in question.

"All requests for this circular should be addressed to

DR. VICTOR A. NORGAARD,
Territorial Veterinarian,
Honolulu.

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FIGHT AGAINST GLANDERS.

As stated elsewhere in this report, (see p. 218) the result has been highly gratifying as far as the apprehension and destruction of a large number of cases are concerned, and this branch of the work of the Territorial Veterinarian will be pursued unremittingly. In every case where an animal has been destroyed for glanders, a careful post-mortem examination has been made in order to verify the diagnosis, and specimens preserved

whenever interesting conditions were found. These specimens are now on exhibition in my office.

Besides destroying the unquestionably affected animals, all other horses or mules in the same stable, or which had come in contact with the affected animals, have been mallein tested and the stables and premises carefully disinfected. The details of this important work have, as far as Honolulu is concerned, been performed by the practicing veterinarians under my supervision, while outside of Honolulu the work has been done by myself.

### ANIMAL QUARANTINE STATION.

Through the courtesy of the Superintendent of Public Works the animal quarantine station in Kalihi has been placed in thorough repair and a small office building added. Instruments for post-mortem work and a stock of disinfectants are kept here and all affected or suspicious animals are sent there for destruction or to be kept under observation. A caretaker has been appointed whose duty it is to attend to the keeping of all animals sent to the station and to bury the dead ones.

### STATE OF THE LIVE STOCK INDUSTRY IN THE TERRITORY OF HAWAII.

As far as the live stock industry in general is concerned, a fairly good idea may be formed by observing the cattle and sheep which are shipped from the various islands to Honolulu, for slaughter. It is at once noticed that all the cattle are grass fed and their condition varying to a great extent, owing to the great variety of climatic and other conditions prevailing on the different Islands where cattle are raised.

### LACK OF BREEDING.

It is further observed that the greater majority of the animals show no breeding but are unimproved native stock. There are, however, exceptions. From two ranches at least have I seen consignments of steers arrive in which nearly every animal showed a decided strain of either Shorthorn or Hereford, and it is simply a question of time when the continued importations of registered breeding stock will make its

impress on all of the herds in the Islands. Furthermore, there is little encouragement at the present time in shipping high grade steers to the market. They bring no higher price than common steers in the same condition, and the fact that they carry more beef and of a better quality on the high priced cuts (ribs and loin) is entirely lost sight of.

The top price of the day, as established by the purchasers and based upon the average available supply of common steers at a given season, is never exceeded, and the owner of high grade steers is at a decided disadvantage. This condition, however, will undoubtedly regulate itself when the high grade steer becomes the rule and not the exception.

## WEIGHT OF CATTLE.

The majority of the steers which come to the Honolulu market are four years old or over, and vary, according to their condition and the locality where they have been raised, from 700 pounds to 1000 pounds live weight. When in prime condition they dress out well, some bunches averaging fifty-five to fifty-eight per cent.

The sheep killed for consumption in Honolulu are small and seldom more than half fat. Like the cattle they are only grass fed, but owing to the limited supply they fetch comparatively good prices.

During the past year I have visited the principal Islands in the Territory, but as there are many sections where I have not yet had opportunity to make any observations it should be borne in mind that the conclusions set forth in this report, in some cases are of local interest, while in others they cover a wider scope. My general impression, however, is that all classes of live stock in the Islands fail, in a more or less pronounced degree, to attain the size and quality which the apparently perfect climatic conditions would warrant, and that the young stock matures slowly.

## CAUSE OF INFERIORITY.

I was at first inclined to ascribe this to inbreeding, but soon found that even where fresh blood had been introduced regu-

larly, the offspring frequently failed to attain the size and development which characterizes similar breeds on the mainland and in other countries. Still there seemed nearly always to be an abundance of feed, and such conditions as in other countries are considered detrimental to the development of stock, a more or less prolonged winter for instance, were unknown here. When one has seen the great plains in the Southwestern part of the United States, where each cow or steer requires from 16 to 20 acres for its support; but where, in spite of the scarcity of grass, they attain the required size, and has compared them to pastures in these Islands, often covered with an abundance of grasses, which elsewhere are considered nutritious; then it becomes evident that something is lacking in the soil and consequently in the food, the absence of which prevents growth and development. I do not mean to imply that this is the case everywhere in these Islands; there are no doubt places on certain Islands and pastures on certain ranches, where the grasses contain everything required for the development of young animals, but most frequently such localities are utilized for other purposes, and such pastures are generally used as fattening paddocks and not as breeding paddocks, and in neither case do the young animals obtain what they require.

## INSUFFICIENCY OF LIME.

It was, however, not until quite recently that this deficiency in the food was brought so forcibly to notice that it became evident that the losses resulting therefrom were very great, and that measures should be taken to check the same. On the Island of Hawaii, for instance, a number of animals, especially calves, yearlings and heifers with their first or second calf, have been dying, especially on Hilo grass ranges, and even though these are covered with green succulent grass and the animals eat an abundance thereof, they have the appearance of starving. They become weaker and weaker and finally lie down and die, the death struggle often lasting twenty-four hours or more. On post-mortem examination it appears that all of the internal organs are in apparently normal condition, though the

tissues are rather pale and the blood thin. But the stomachs and intestines are full of partly or completely digested grass and there are no flukes or other intestinal worms. In fact we only find a more or less pronounced anemic condition, in every respect bearing out the ante-mortem appearance and symptoms. However, if we look a little further, remove the unpliable hide, and cut away the pale flaccid muscles from the bones we come to the seat of the trouble. In removing the muscles from the shoulder blade, for instance, it will be noticed that the periosteum—the white tough membrance which covers all bones directly—which in the healthy animal is very firmly attached to the bones, strips off easily and that the exposed bone is of a bluish, half transparent color. A tap with the heel of the boot will shatter the bone and the pieces may be sliced with a butcher knife like a shingle. This condition, known as *osteomalacia* or softening of the bones, is due simply to an insufficiency or total absence of lime salts in the food.

## CONFIRMATION BY EXPERIMENT STATION.

The observation of this disease in certain sections of Hawaii and Maui at once threw light on a number of conditions throughout the Islands which hitherto had been more or less mysterious, and when I was informed by Mr. Jared Smith of the U. S. Experiment Station that a number of chemical analyses of grasses from various parts of the Islands had revealed a deficiency in lime salts, I felt convinced of having reached the root of many evils and began to realize that much could be done to remedy them. For instance, I had noticed that fractures of bones in grown animals—cows, steers, bulls and especially bullock horses—were more common here than in most other places. During the past year I have seen or heard of at least twenty cases of broken legs, not counting any which may have occurred on lava flows, and I feel convinced that even though the surface of the Islands for the greater part is rough and stony so many fractures would not occur unless there was something materially wrong with the bones of the animals.

## BIG HEAD IN HORSES.

Another disease of the bony system which prevails here to a great extent is *osteoporosis* or big head in horses and mules. The true nature of this disease is not known, but it seems probable that it is due to some form of malnutrition of the bony system. I have seen this disease on all of the Islands I have visited, though it seems to cause the greatest loss on Maui. A description of this disease as well as of osteomalacia in cattle will be given under separate heads.

## AN UNBALANCED RATION.

It is, however, not the actual loss by death which results in certain sections of the Territory from this deficiency in mineral matters in the grasses, which is of most economic importance, but the incalculable waste of time and material resulting from an "unbalanced ration." By a "balanced ration" we understand a given amount of food which contains in proper proportion all of the ingredients necessary for the maintenance, growth and development of each and every tissue of the animal economy and for the production of heat and energy.

If any one of the required ingredients is missing or deficient, the tissues or functions which remain unsupplied will, as a rule, not suffer alone, for the economy will endeavor to equalize the ration by giving off spare or surplus products from one tissue to another, converting the same to meet the demands of the neglected tissue or organ. It will therefore be seen that when the ration becomes unbalanced by a deficiency of mineral matters it will not alone affect the bony system, even though this is first to suffer, requiring as it does the major part of the mineral matters assimilated with the food, but every other tissue or organ containing or requiring mineral matters, all of which do to a greater or less extent, will suffer in proportion. When we further consider that the young and growing animal requires an excess of lime salts to build up its boney system, upon which all other tissues and organs depend for support, then it can be realized what an immense influence a general deficiency in lime salts will have upon the live stock industry of a country.

## THE ONE DEFICIENCY.

Excepting this one deficiency, we find that every other requirement for making this Territory an ideal place for live stock raising is present. It is a well established fact that a pregnant animal will supply the fetus with everything required for its development even though the mother must convert its own substance for that purpose, and will continue to do so after the young one is born, dissolving its own bones to provide the lime salts in the milk, unless an abundance thereof is available in the food.

## EFFECT UPON SHEEP.

This is well illustrated in certain sections, where the said deficiency is not very pronounced. On Molokai, for instance, all lambs are born strong and well developed, and so long as they receive plenty of lime salts through the mothers' milk, they gain rapidly in size and weight. When about four months old they are generally weaned, at which time many of the best lambs weigh from 55 to 60 pounds, while the majority average 50 pounds. This would indicate that the conditions up to that point have been as favorable as could be desired. But no sooner are the lambs weaned before an almost complete standstill in the development takes place, and further growth is resumed but slowly. When 12 months old they only weigh from 60 to 70 pounds, the best lambs of the following season being heavier than the less good yearlings. There is certainly a discrepancy here which can only be accounted for in the way indicated. From the time of their weaning the lambs have subsisted on grass, but even though they have had an abundance thereof, they have only developed in direct proportion to the actual amount of lime salts which they have assimilated with the food. The deficiency in lime salts has unbalanced the ration and the resulting excess of proteids and carbohydrates, which have been consumed by them, have simply been wasted, and for either breeding or marketing purposes, the young animals have received a set back from half a year to a year. When the yearlings finally are bred and have to provide lime salts for the formation of the skeleton of the fetus, their retarded

development again comes to a standstill, and so on, until they reach the age where no further growth takes place, without ever having attained the size which, under more favorable circumstances, would have been realized.

### EFFECT ON CATTLE.

Where the deficiency in lime salts is more pronounced, as on certain parts of Hawaii, the conditions are as stated more serious. In the first place the young and undeveloped animals are often bred too young, with the result, for instance, that heifers become runts and the calves are born small and weak. If the mother is a good provider, she will sacrifice herself for the calf, which will soon become strong and gain rapidly, until, as is often the case, the mother dies. If the calf survives it will, as a two year old, be the size of a yearling, but with a large stomach and an old look. If the mother lives the calf will develop normally, so long as it receives milk, and the heifer will get in calf again. She has then to maintain her own bony system, provide a new skeleton for the fetus and supply the required amount of lime salts in the milk to the calf at the foot. This, as a general rule, proves too much of a strain on her system and it is therefore principally this class of animals which develop typical osteomalacia and succumb to it.

### EFFECT ON HORSES.

What has been said here about cattle and sheep applies, though to a less extent to most horses and mules raised in the Islands. They lack bone, develop slowly and mature late, and unless grain fed or supplied with food containing lime salts, fail to attain size. There is an abundance of horses in the Islands, but they are of little value for the reasons mentioned, and both mules and horses are constantly imported in considerable numbers. During the past year there has, for instance, been imported over $60,000 worth of mules. As far as I am able to judge I do not see why these mules could not equally well have been raised here, and I shall shortly describe the method by which I believe it possible to a great extent to

relieve the condition which, in my opinion, is the only serious obstacle to this Territory producing live stock of all classes, in sufficient numbers to supply the local demand.

## THE BEEF SUPPLY SUFFICIENT.

From slaughter-house and other statistics it would appear that the Islands are well able to supply the local demand for beef, and the price at which it is retailed in Honolulu is reasonable. All beef consumed in the Islands is purely grass fed and the general condition of the cattle shipped to market is therefore, to a great extent, dependent upon the more or less favorable climatic conditions, the season of the year and the available supply of feed in the paddocks on the various Islands.

As grass fed cattle on short feed lose flesh a good deal quicker than they can put it on under more favorable conditions, and as the warm and cold, dry and wet seasons coincide to a certain extent on all of the Islands, it will be seen that fat cattle cannot, as a rule, be supplied at all times of the year. For this reason about fifty per cent. of the cattle which come to the Honolulu market are only half fat, some of them not even that; but as the demand must be supplied, cattle are constantly shipped to market which, if they could have been held a little longer, would have brought their owners a better price. This condition can only be remedied when feed stuffs, other than grass, are grown and harvested in the Territory in sufficient quantities to insure against a shortage at any time, and make the present stock raiser and the future stock feeder independent of climatic conditions.

## SHORTAGE OF MUTTON.

As far as sheep are concerned the supply does in no way satisfy the demand. There are approximately 100,000 sheep in the Islands, but nevertheless there were imported for the Honolulu market, during 1905, 3013 carcasses of mutton from California, of a net value of $13,341.00.

All Island grown mutton and lamb is, like the beef, purely grass fed. Practically no attempt has been made, so far, to fatten either lambs or sheep before shipping them to market, as is

being done in every other country. On the mainland a comparatively small number of fat weanling lambs are sent to market and sold at fancy prices. All other classes of sheep are prepared for market in either selected pastures, cultivated fields or in the feed yards.

### SHEEP SHOULD BE FATTENED.

Both lambs and wethers respond so willingly to feed given them, however small the amount, that it has been found unprofitable to market them half finished as is being done here. For instance, a ration of one-half pound of grain per head, in addition to good pasture, will increase the gain in weight 60 per cent. If such ration could be made to contain an abundance of lime salts the speedy development and growth of the young animals would be increased. Both corn and alfalfa, the feeds most commonly used for lamb feeding, can be raised cheaply in certain sections of several of the Islands, and in some cases close to the sheep ranges.

### A WYOMING EXPERIMENT.

To illustrate what can be gained by feeding lambs under circumstances and conditions which can easily be duplicated in this Territory, I shall quote the following from Bulletin No. 64 of the Wyoming Experiment Station, entitled "Feeding Experiment with Lambs": "Sixty lambs fed for one hundred days on eleven and six-tenths acres of field pease which were raised on sod land without irrigation. These lambs harvested the crop, made better gains and went to market in better condition than the lambs from the feed pens which were fed alfalfa and corn." It is further stated that it is impossible to tell what portion of the crop was wasted, but by comparison with the foods consumed in other rations it is probable that not more than sixty or seventy per cent. of the total crop was consumed. Four varieties of pease were used—White Canadian, Green Canadian, Golden Vine and Mexican. The lambs gained an average of 24.9 pounds per head, and were remarkably well and thrifty throughout the experiment. They were made up of twenty-two Shropshire crosses on Merino ewes, averaging a little over forty-eight pounds per head, and

thirty-eight small Merino crosses (mostly runts), averaging 35.5 pounds per head. The large lambs did much better than the smaller ones, in fact they gained an average of 29.91 pounds during the first 90 days, while the smaller ones only gained 23.14 pounds during the same period. This would mean that the larger lambs, when shorn, could have been marketed between six and seven months old, weighing about 75 pounds each and dressing out 56 per cent. of the live weight, or 42 pounds each."

With the prices now prevailing here such lambs should bring at least 11 cents per pound, or $4.62 per head, a price which is rarely realized here for wethers at 10 cents per pound. If a similar experiment were to be made here, starting in with strong lambs weighing 50 to 60 pounds, the result would undoubtedly be much better.

## HOG PRODUCTION POSSIBILITIES.

As far as hogs are concerned there is annually imported between $35,000 and $40,000 worth of them.* The high price paid here for hogs, about 10 cents per pound live weight, would seem an incentive for investigations as to the conversion of waste products into pork. The principal waste product of the Islands is molasses, which contains a high percentage of carbohydrates in their most easily digested form, that is, sugar. The proteids could in my opinion be obtained from the abundance of otherwise worthless live stock which is now consuming a large proportion of the grasses of the Islands, for which their hides and carcasses will never pay. There are thousands of such animals in the Territory,—wild cattle and goats, old cows, worthless horses and donkeys, and ranged out ewes,—which could be killed, boiled down and converted into pork, when fed with molasses and roughage. Besides there is the Algaroba bean, the supply of which is constantly increasing and which forms an excellent feed for hogs.

This is a suggestion only, the practical value of which must be demonstrated through experiments, but the success of hog raising in connection with slaughter houses is so well demonstrated as to leave little doubt as to the final result if undertaken in

* The Metropolitan Meat Co. alone imported 2510 head of the value of $26,294.00.

places where the suggested material can be obtained in abundance. The importers of hogs now pay 2¼ cents per pound, live weight, in freight from San Francisco to Honolulu, so it would appear that there is a bounty on hog raising in this Territory unequaled in any other country.

## RECOMMENDATIONS.

### CORRECTING THE DEFICIENCY IN LIME.

As already stated I ascribe the failure of the live stock breeders to supply the local demand for all classes of live stock and their products to a more or less pronounced deficiency in mineral matter, especially phosphate of lime, in the soil and subsequently in the grasses of this Territory. I further hold that if this deficiency is remedied all classes of young stock, lambs as well as calves and colts, will continue to develop without interruption after they are weaned; they will mature earlier and be able to bear strong and well developed offspring without detriment to themselves, and to supply this offspring with an abundance of milk containing the requisite amount of lime without having to draw on their own economy for it.

There are two ways in which this can be accomplished, either by liming the soil or by giving the lime salts to the animals direct. As the first way is out of the question, owing to the large acreage which would have to be treated, the administration of lime salts, in the form of licks, must be resorted to.

Wherever animals are observed to have developed depraved appetite, eating manure, decayed wood or dirt, and especially where they are seen chewing bones, it may safely be concluded that their system is craving something which is missing in their food, and treatment should be begun at once.

### BONE MEAL AND MOLASSES.

The safest and cheapest method is to place an abundance of bone meal, mixed either with salt or with molasses, where the animals can have constant access to it. Bone meal contains fifty per cent. of phosphate of lime and, when ground sufficiently fine, the greater part of it will be digested and reach those parts of the system where it is needed.

There are other forms in which the bone-building material may be supplied, for instance as superphosphate of lime, which is slightly cheaper than bone meal, but it is an acid salt and cattle will not eat it when mixed with common salt. It contains more available phosphoric acid than bone meal, but when given in molasses there is always the danger of some animals eating too much of it.

In many places, especially where the drinking water is brackish, cattle will eat little or no salt, and the best results, particularly where it is desired to get the animals to take the lick quickly, have been obtained by mixing the bone meal with molasses. In the first place the molasses contains carbohydrates in the form of sugar, and in the second place there is a certain amount of lime in it. (Lime is used in the manufacture of sugar to clarify the cane juice).

Furthermore, the cattle as soon as they get used to it, will eat any amount of molasses, while they will only take a limited amount of salt. Hence in using molasses the treatment with bone meal is more easily regulated.

## EXPERIMENTAL FEEDING WITH BONE MEAL.

On a ranch on Hawaii, where, in certain sections the deficiency is lime salts is very great and where the mortality from osteomalacia has been considerable, an experiment was begun in the beginning of January this year, 1906, in which 85 cows and some large calves, all in very poor condition, were submitted to this treatment. The animals were taken from Hilo grass range and were placed in a small paddock close by and which also contained nothing but Hilo grass. These animals were therefore kept under exactly the same conditions as those on the adjoining plains, where many deaths occurred.

The mixture was prepared by adding 10 pounds of superphosphate of lime to 70 pounds of bone meal, and then mixing with 250 pounds of molasses. The whole was worked together till it formed a homogeneous mass. A twenty-four foot V-shaped trough, made of two twelve-inch planks, with end pieces and braces, was placed in the paddock and the mixture transferred to it. For one week the cattle were herded around the trough for

an hour each day, efforts being made to get as many to taste the mixture as possible. After that the animals were left alone, but it was easily noticed that a number of them, if not all, returned regularly to taste the mixture. On January 12th, ten days after the beginning of the experiment, there was a noticeable improvement in a majority of the animals. On February 3rd the manager of the ranch where the experiment was being made, wrote as follows:

### RESULT OF THE EXPERIMENT.

"Just a line or two about the cattle-bone-meal experiment that you started some time ago.

"On January 19th I put three-quarter barrel of molasses, one bag of bone meal and 15 pounds of superphosphate in the paddock where this experiment is being carried on.

"This amount was all eaten by Wednesday, the 31st, or in 11 days. There are 85 cows and some large calves in this paddock,—say 100 head altogether. They therefore consumed about 400 pounds of molasses, 130 pounds of bone meal and 15 pounds of the superphosphate, which would make about 5 pounds per animal, or 4 pounds of molasses and 1.3 pounds of bone meal in 11 days.

"I did not herd the animals at all, and they consumed this amount at their own free will. The cattle are much improved, and I feel justified in putting in several feeding boxes on different parts of the range."

### ANALYSIS OF GRASSES FOR LIME.

In reply to this letter the following was sent:

"In order to more definitely decide the lack of lime salts in the grasses on the ranch, I would ask you to send samples of the grasses from all pastures where you suspect that this deficiency obtains, in order that I may have them chemically analyzed. The grass should be cut green, each sample to consist of ten pounds. After weighing, the grass should be allowed to dry, then wrapped into bundles and numbered. A description of the locality and general condition of the pasture, together with observations as to

how the cattle thrive in said pasture, should be furnished with each sample. The samples should be sent to Dr. E. C. Shorey, of the U. S. Experiment Station, Honolulu, who has kindly agreed to analyze them and to report the results to me.

"I would suggest that one of the samples be cut from the paddock where we have been feeding bone meal and molasses.

"I would also ask you to send Dr. Shorey a sample of bones from animals which you suspect to have died from osteomalacia. I believe it will be safe to take any of the bones from heifers which you may find on the Hilo grass plains. The samples should contain the shoulder blade and one or two of the heavy bones, and should comprise about five pounds all told."

FURTHER RESULTS.

Again on February 23rd the manager wrote as follows:

"I am in receipt of your favor of the 14th inst. and in reply beg to say that I will attend to the matter of grass and bone samples as soon as I can give them my personal attention.

"I can report good results from the paddock experiment with bone and molasses, but the range cattle have not as yet 'caught on.' They probably will later, though."

One month later, on March 23rd, the following letter was received:

"I beg to acknowledge receipt of your favor of the 20th inst., and in reply would say that it is impossible at the present time to note any improvement in the range cattle that have been eating the molasses mixture. I do not believe the range experiment will prove a success from the fact that the cows that really need the stuff are constantly fought off by the stronger ones. Again I find that the horses are very fond of it, and I figure they get away with about half that we put out. My present idea is to build a paddock specially for the weak cows, and feed them the mixture in the paddock.

NO LONGER AN EXPERIMENT.

"I am continuing the paddock experiment. This bone meal feeding is no longer an experiment, as I am thoroughly convinced

it is just what the animals need. The cattle that have been eating it are looking 50 per cent. better."

Again on April 27th the manager writes:

"I have not put out any of the molasses mixture on the plains as we have been having so much rain, and the troughs being uncovered I find that the mixture sours on top to a depth of about two inches, and the cattle refuse to eat it. Just as soon as I can get around to it I intend to build sheds over the troughs.

"If the rain lets up I will again send out the stuff."

From the above correspondence it will be seen that 200 pounds of bone meal and 650 pounds of molasses, besides a slight amount of superphosphate of lime, fed to 100 animals in the course of one month, caused a decided improvement in their condition and appearance.

The same treatment was continued until I again visited the ranch during the month of April. The 100 experiment animals had then consumed about 14 bags of bone meal and 7 barrels of molasses. It would simply have been impossible to recognize the animals in question as the same bunch of hides and bones with which the experiment was begun some three and one-half months earlier.

With the exception of three old cows, which from the appearance of their rough coats had never touched the molasses mixture, every animal, whether cow, heifer or calf, was in splendid condition. Their hides were soft and sleek and rolled freely over the well rounded bodies, in fact the entire herd, with the noted exceptions, gave the impressions of perfect health.

The calves which had been born since the beginning of the experiment showed a contrastingly strong development of bone and a complete absence of the bloated pendant stomach which had characterized the calves on the Hilo grass plains.

### COST OF BONE MEAL FEEDING.

Bone meal costs according to its fineness $28.00 to $30.00 per ton, and the superphosphates $26.00 per ton. The molasses can be obtained at many plantations for a reasonable charge as quantities of it are allowed to run into the sea. Consequently only the cost of transportation from the nearest mill need to be considered.

This, however, in connection with the distribution of the mixture in various paddocks or on open ranges will on large ranches undoubtedly be an item of importance. I expect, however, through continued experiments to be able to reduce the bulk of the mixture considerably by adding a greater amount of bone meal to a correspondingly smaller amount of molasses.

I am of the opinion that where the deficiency of lime salts is greatest, one ounce of bone meal per day is sufficient for all young stock and for breeding stock, and much less for steer cattle. Consequently one ton of bone meal will furnish 32,000 doses or be sufficient for one thousand head of such stock for about one month, if properly administered and waste avoided.

## BONE MEAL THE REMEDY.

That the decided improvement in the experiment animals under consideration was due to the bone meal and not to the molasses is evident when we consider that each animal received but six pounds of molasses during a period of one month. This amount of molasses containing perhaps two to two and a half pounds of digestible carbohydrates would not constitute one single ration for a grown animal, unless the requisite amount of proteids was furnished to balance it. And the very fact that the animals began to improve almost from the very start, plainly indicates that the hitherto missing lime salts accomplished what was expected of them; that is, to balance the daily rations of grass. In doing so the animals received the full benefit of what they eat and immediately began to show the effects thereof.

## BONE MEAL EXPERIMENT ON MOLOKAI.

In regard to the bone meal and salt mixture I herewith give a letter from the manager of the American Sugar Company's ranch on Molokai:

"The bone meal and salt were mixed and put in two pastures, one with the young Devon bulls, the other with the young lambs for market; neither have eaten it to any appreciable extent, and I will order molasses to see if that will induce them to take it. The Devon cow herd is at present on a large pasture and watering at a

brackish well, so I will defer trying it on them till I have them on a smaller pasture."

It will be noticed that this treatment up to date has not been a success, but I believe that in places where the deficiency in lime salts is but slight and where the cattle or other animals eat salt regularly, a mixture of half and half bone meal and salt will prove beneficial.

### ADMINISTERING LIME IN WATER.

Where live stock is watered from troughs a further supply of lime may be administered by placing a sack of lime, say ten pounds, in each trough. The lime should be slaked before being placed in the sack. Lime requires 750 times its own weight of water for solution, but by leaving it enclosed in a sack and undisturbed at the bottom of the trough a much smaller amount will be dissolved. If constantly stirred a saturated solution (1 to 750) would form and an animal drinking ten gallons of water in a day would receive 1.7 ounces of lime, which would be far in excess of what the system could take care of.

Lime administered in the drinking water does, however, not benefit an animal to the same extent as bone meal, as it is in the form of calcium oxide, which must be combined with phosphoric acid before it can be utilized by the animal economy. This manner of treatment should therefore be adopted only where chemical analysis has demonstrated that the grasses or other feeds contain a relatively higher proportion of phosphoric acid than of lime, or else where superphosphate of lime is fed with molasses instead of bone meal.

### ANALYSIS OF FOREIGN AND HAWAIIAN GRASSES.

For the comparison of the percentage of lime and phosphoric acid in grasses grown in foreign countries and in this Territory, the following figures are hereby given:

| | Lime. | Phosph. acid. |
|---|---|---|
| Rich pasture grass | 0.26 | 0.19 |
| Orchard grass | 0.11 | 0.13 |
| Rye grass | 0.15 | 0.22 |

| | | |
|---|---|---|
| Timothy | 0.17 | 0.24 |
| Alfalfa | 0.85 | 0.16 |

The above are all German analyses, taken from Prof. E. von Wolff's tables.

| | Lime. | Phosph. acid. |
|---|---|---|
| Alfalfa, Waialae | 0.45 | 0.30 |
| Hilo grass, U. S. Experiment Station | 0.08 | 0.26 |
| Manienie, U. S. Experiment Station | 0.14 | 0.49 |
| Pili grass, Punchbowl | 0.26 | 0.40 |
| Paspalum dilatatum, Kamehameha Sch. | 0.12 | 0.11 |
| Panicum crus-galli, Kamehameha Sch. | 0.02 | 0.21 |

The last analysis, panicum grass, shows a very high percentage of phosphoric acid and an extremely low percentage of lime. It would therefore be advantageous to give lime in the drinking water where this grass forms part of the daily ration. The analyses of these native grasses and fodder plants have been made by Dr. E. C. Shorey of the U. S. Experiment Station, Honolulu, but as will be seen they are all from Honolulu or vicinity, where the soil is known to contain one per cent. or more, of lime. It is therefore not given that Pili grass from Molokai, or Hilo grass from Hawaii, will contain the same amounts of either lime or phosphoric acid, and Dr. Shorey is now at work analyzing a number of samples of grasses from various Islands and has kindly offered to do the same with any samples which are sent to him from places where conditions would indicate that mineral substances are lacking in soil and plants. Such samples should be gathered and prepared according to the direction contained in the letter printed on page —, and as soon as the results of the analyses reach me I shall suggest such treatment as would in each case seem indicated.

### HAWAIIAN BONES ONLY SHOULD BE USED.

In the mean time it would be safe for all live stock breeders who are not satisfied with the development of their animals to begin experimenting with molasses and bone meal. In ordering the latter it must be insisted on that only Hawaiian bones be used in making the meal. Fatal infectious diseases, as blackleg and anthrax, have been introduced into New Zea-

land and Australia with importations of bone fertilizers, and as these diseases do not occur in this Territory it is only safe to use the bones grown here.

The finer the bone is ground the more of it will be utilized by the animals and the more economically it may be fed. The formula now used on the ranch on Hawaii can be recommended for such experiments in a general way, the principal point being to get the animals to eat it. When first they get acquainted with the taste and smell of the molasses the composition can easily be changed to suit various localities. The lick troughs should always be located near the watering places or else, during warm weather for instance, in shady places where the animals herd together at certain times of the day.

## REPORTS REQUESTED.

If the stock raisers who undertake such experiments will report to me their observations, together with such suggestions as may lead to improvements in the method of administering the treatment, I have no doubt that valuable information will speedily accumulate and conclusions be reached, which, when published, would benefit all interested parties.

Where the rainfall is high it is advisable to place the troughs under sheds to avoid the fermentation which will take place when water is mixed with molasses and then exposed to the rays of the sun.

## SEGREGATION OF HEIFERS AND CALVES.

When breeding stock and steers are running in the same pasture or on open range, it is advisable to segregate the heifers and calves to be sure that they get the required amount of bone meal. Horses, as has been seen, are very fond of the mixture and eat excessive quantities of it. It should therefore be an easy matter to raise both horses and mules big enough for the heaviest plantation work and with a bony system immune to osteoporosis and fractures. Simply keep an excess of bone meal and molasses before them and the native grasses and the climate will do the rest.

## DEFICIENCY IN LIME ELSEWHERE.

That this Territory is not the only place where deficiency in lime salts has proven a severe obstacle to the development to the live stock industry, would appear from a number of articles in a copy of the Agricultural Journal of the Cape of Good Hope, February, 1906, and which has just reached this office.

Under the heading, "Feeding Broken or Crushed Bones to Cattle," Dr. Hutcheon, Acting Director of Agriculture, reports on a number of experiments which have been made for the purpose of ascertaining how far the *herbivora* (plant eating animals) are able to digest bones. It is a well known fact that the *carnivora* (meat eating animals) are well able to digest bones; the same remain in the stomach until they have been completely dissolved by the gastric juices. In the herbivora, however, only the fourth or true stomach contains secretions which are able to digest bones and when the food reaches this stomach it is so well prepared for digestion that it remains there but a comparatively short time. It is, therefore, necessary that bone should be given in as small particles as possible in order to be acted upon to the fullest extent in the fourth stomach. Dr. Hutcheon fed coarse crushed bone varying in size from 1-6 to ½ an inch in diameter. These pieces of bone were passed by the animal without showing the slightest traces of action by the digestive juices. The sharp edges were not even rounded nor was the spongy part of the bone acted upon. In another experiment a two-year-old steer was given 1 pound of coarse bone meal per day for seven days, and it was found that this excessively large amount was completely digested, none of it being passed by the steer. The pieces of bone, as well as the bone meal, had been dyed blue with fast color, in order to be more easily recognized when passed.

## GOVERNMENTAL ACTION IN CAPE COLONY.

The Government of the Cape Colony has realized the absolute necessity for the artificial feeding of mineral matters to the live stock in various districts of South Africa, and has even gone to the extent of establishing depot agencies for supplying

bone meal at cost. From these agencies guaranteed sterilized bone meal is sold to bona fide farmers at terms published in an official regulation dated December 15, 1905.

In the same number of the Agricultural Journal of the Cape of Good Hope appears a note headed, "Bone Meal and Lamziekte." (Osteomalacia,) and which reads as follows:

"Mr. John T. Smith, Secretary of the Langeberg Farmers' Association, writing to the Acting Director of Agriculture and offering the sincere thanks of his Association for the establishment of the bone meal depot at Oliphants Hoek, incidentally gives his experiences in the use of that article as a preventive of lamziekte, (osteomalacia). He says, 'I have a herd of cattle, some 200 in number; I have been using bone meal for two years and have not lost one head during that time from lamziekte, (osteomalacia) though my neighbors lost heavily. Before using bone meal I lost between 90 to 100 head of breeding stock in 12 months.' He concludes by stating that he is quite convinced of the efficacy of bone meal and so are many of his neighbors though, they will not all own it. Now that this commodity is obtainable at a reasonable cost close at hand, the work of conversion should proceed faster."

## BONE MEAL FOR STOCK IN GERMANY.

I am also in receipt of a German circular which highly recommends prepared food-bone-meal for all young stock and dairy cattle. This preparation, however, retails at one hundred dollars per ton and contains only thirty-three per cent. of phosphate of lime, while ordinary bone meal contains from fifty to sixty per cent.; and as observations made in South Africa have fully demonstrated that the plant eating animals are well able to digest the ordinary bone meal, there would be no reason for using a more expensive preparation simply because it is more soluble.

Osteomalacia also prevails to a more or less pronounced extent in various European countries, the treatment adopted being practically the same as that recommended here; that is, the regular feeding of bone meal.

In conclusion I must reiterate that I believe that the rational feeding of bone meal to all classes of stock, but especially to young animals, and female breeding stock, will prove of incalculable value to the entire live stock industry of the Territory.

## DISEASES AMONG LIVE STOCK IN THE TERRITORY.

In accepting the office of Territorial Veterinarian in July, last year, I made the following statement to the Commissioners of the Board of Agriculture and Forestry: "Although my observations have been limited, they nevertheless indicate that this Territory is singularly free from most of the infectious and contagious diseases which cause such heavy losses annually on the mainland and in other countries, as for instance Texas fever, blackleg, foot and mouth disease, anthrax, rabies, contagious pleuro-pneumonia and others."

This statement still holds good as far as these diseases are concerned, though the past year has made it apparent that there are diseases and conditions here which require undivided attention and careful investigation unless they are to become serious obstacles to the development of the local live stock industry or cause heavy losses among the work animals in the Islands. I especially refer to osteomalacia, osteoporosis (big head in horses), true glanders and farcy, and a disease which in many respects closely resembles glanders, although less malignant, and which is very widespread on several of the Islands, if not on all.

### ORIGINAL INVESTIGATIONS NECESSARY.

Three out of these four diseases have been given but scant attention by modern investigators and veterinary text books refer to them briefly, if they mention them at all. In combating them we are therefore left to our own resources, and, the last legislature having failed to provide funds for such work, it would seem that the present conditions must either be allowed to continue as hitherto or private enterprise must provide the means for investigation. Without a thorough knowledge of the nature and cause of a disease, preventive measures

can only be guessed at, and where such sums are involved, as for instance those invested in work animals on the sugar plantations, it is obvious that uncertainty should be eliminated as far as possible and that all sanitary as well as preventive measures should be based upon thorough scientific research.

### NEED OF LABORATORY AND LIBRARY.

To accomplish this a pathological and bacteriological laboratory, together with a reference library containing the principal books, magazines and periodicals on the subject of veterinary science, would be required and until that is forthcoming no real headway can be made in our knowledge of the animal diseases of these Islands. Especially in reference to the horse disease above referred to I have felt badly handicapped in making a diagnosis for want of the requisite instruments and reference books, and as thousands of animals appear to be affected it would seem that an early investigation would be desirable.

### OSTEOMALACIA OR BONE BRITTLENESS.

The nature and cause of this disease as well as its treatment have already been discussed, so it will only be necessary here to give a short summary of the principal symptoms by means of which owners or caretakers of live stock may be able to decide for themselves whether their stock is affected and to what degree.

*Symptoms:* In the first stages of the disease it is impossible clinically to diagnose osteomalacia. The animals, especially heifers with first or second calf, may appear unthrifty; there is depraved appetite, the animals eating decaying wood, dirt or manure, or may be seen standing for hours chewing an old bone. Gradually the unthriftiness becomes emaciation, the coat becomes staring and symptoms of gastro-intestinal catarrh (indigestion) and anemia appear. The animal moves with a slow, painful and stiff gait, often accompanied by crackling of the joints, and evinces pain in lying down and getting up The visible mucous membranes become pale, often white, and there may be swelling and soreness of the joints. The appetite which at first may be voracious gradually becomes more

and more precarious. There is a decided disposition to fractures of various bones, especially ribs and shoulder blades, but also of the limbs and hip bone, and such fractures show little or no tendency to heal. The animals finally become too weak to seek food or water and lie down never to get up again, or, if near a water hole frequently mire down and drown. For the post-mortem appearances see page 184.

*Treatment:* This should consist principally in the artificial feeding of lime salts as described on pages 192 to 203. As far as dairy cows and other animals, fed in stables, are concerned, foods containing mineral salts may be given, such as beans, cowpeas, oats and cotton-seed meal. Algaroba beans are very high in lime, especially if the seeds have been ground up. Alfalfa is also high in lime, the contents of mineral matters depending to a great extent upon the soil on which it is grown. Alfalfa will, however, not thrive on a soil poor in lime salts, so it may always be depended upon to contain sufficient lime to supply the demand of the animal economy. The same is the case with field peas and other legumes.

### OSTEOPOROSIS OR BIG HEAD IN HORSES.

Osteoporosis, or big head, is a disease which presents itself under a variety of symptoms. It may be very mild in nature or be very acute and rapidly fatal. The symptom which, as a rule, is first observed, is an enlargement of the bones of the face or lower jaw, or more rarely of the shoulder. Other bones may show thickening and excessive roughness. The ribs gradually change so that a round barreled horse becomes flat sided, the back becomes straight, and there is a noticeable dropping of the croup. In young animals there is a tendency for the back to become elevated or arched.

Simultaneously with these bone changes there appears a peculiar lameness which comes on very suddenly and is difficult to locate. There is no heat, swelling or pain, over any part to locate it by. We simply know that the animal is lame. The lameness is of a migratory character, being in one limb one day and in another the next. It ceases as quickly as it comes. The animal assumes a peculiar gait. There is little shoulder movement, the steps are short and executed as if there

was stiffness in all the joints. The hind legs are carried further under the body than natural, thus giving every appearance of chronic founders.

In the milder forms the appetite remains about normal and the animal is capable of doing a fair amount of work. In other cases the appetite persists, but the animal is incapacitated for work. The general condition remains fair until after the disease has made severe inroads in the bony system.. Decline then begins and is rapid. There is a slight elevation of temperature but the pulse and respiration remain normal. The animal is easily exhausted on work that ordinarily would be considered light.

The disease often abates, for several days, weeks or even a couple of months or more, but almost invariably recurs in a more aggravated form. We then see soreness and often swelling of the joints and inability to get up or lie down. The temperature rises to 103° or 104° F. Loss of appetite and emaciation follow, and there is a great tendency to fracture of the bones.. The animal succumbs sooner or later from emaciation and complications such as bed sores.

One attack does not confer immunity from the second.

### ALL AGES SUSCEPTIBLE TO BIG HEAD.

Big Head attacks horses and mules of any breed and at any age. Young animals are more susceptible than old ones. Mules are less susceptible to the disease than horses and the termination is more favorable. The disease is very widely distributed, occurring in nearly all parts of the United States, as well as in many foreign countries. It is found under all climatic, soil and food conditions, and therefore cannot be due to any one local cause. It is not uniformly distributed, being of very rare occurrence in some places and altogether too common in others. In this Territory it is prevalent among the work horses and mules in certain localities on Maui, while a milder form, manifesting itself principally by a more or less pronounced swelling of the branches of the lower jaw, is common among the ranch horses on Hawaii. The disease also occurs in a more severe form on the Island of Oahu.

## CAUSE—CONTAGIOUSNESS.

Pathologically, the disease is due to the development of the vascular and fibrous structure of the bones, without a corresponding growth of the true osseous and cartilaginous elements, but whether it is due to some specific micro-organism, or is due to a mal-assimilation of the food, has not yet been decided.

Whether the disease is contagious or not is also unknown. There are cases on record where the disease has persisted for years in one stable, but where, nevertheless, numbers of new horses have been kept for varying lengths of time without contracting the disease. Colts and adult animals may become affected even though they have always been isolated from other animals of their own species. On the other hand there are many cases on record which would indicate that the disease is contagious. For instance, on a farm in Florida, the disease was introduced in 1888 and has remained there ever since. Nine horses and mules have died, and new horses become affected soon after being taken there. No difference can be detected between this farm and others in the vicinity except that perhaps everything is in a better condition. The disease had never been known prior to 1888. In another case four horses died successively in one barn. It burned and a new one was built some distance from where the old one stood. No animals have died since.

Whether the disease may be transmitted by heredity is equally unknown, even though there seems to be a tendency for the offspring of affected animals to develop the disease.

## NO KNOWN CURE FOR BIG HEAD.

So far as the treatment is concerned it may as well be stated unequivocally that no remedy is known which has proved beneficial in a considerable number of cases, and if any sure cures or specifics are offered for sale, as I have seen done here, I would suggest that the owner of affected animals save his money.

It should be kept in mind that the disease is not local, even when it manifests itself by local swellings of the bones, and

any treatment which aims at a local effect, will not be sufficient. To bore holes in the side of the face or jaw filling them with arsenic, iodine, caustic potash, or applying a hot iron or blister, can have but a local effect, besides producing intense pain and suffering, but the intermittent character of the disease has caused a number of such remedies to be reported as infallible cures.

### TREATMENT.

A change of feed, better care, and rest are more potent factors in bringing about the desired results.

Big head will probably make most improvement by turning out on good pasture and allowing rest for five or six months. This should be supplemented with a liberal supply of lime or lime water, but the most important point is to change the feed, regardless of what is being fed at the time when the disease manifests itself. Animals which are fed in a stable may be given one tablespoonful of bone meal in each feed.

It has been suggested that animals which are fed on bran regularly will recover when no more bran is given, but on the other hand, when the disease appears in a stable where no bran has been fed for years, equally good results have been obtained by feeding bran. Other foods containing mineral salts may be given, such as beans, cowpeas, oats, or cotton seed meal.

Lime may be administered in the form of lime water by dissolving a few lumps in a barrel. The water, if not stirred, will only contain a certain amount and may be used without doing any harm.

The treatments here enumerated are now being tested on Maui, and if good results are observed, the same will be published in a circular for the benefit of horse owners in other parts of the Islands, where the disease occurs.

### SHEEP SCAB.

Sheep scab has been one of the greatest obstacles to successful sheep raising in the United States, and great difficulty has been experienced in fighting it.

It is estimated by the United States Department of Agriculture that, with the possible exception of hog cholera, sheep scab causes greater annual loss than any other disease. It is not the actual mortality resulting therefrom, but the deterioration in value of the affected animals as producers of wool and mutton, which is of the most importance.

In the United States a strict quarantine of all States and Territories, or sections thereof, where this disease prevails, has been established and no sheep are allowed to be moved from the quarantined area, except in accordance with the regulations of the Bureau of Animal Industry providing for their inspection and treatment.

## DIPPING IN THE UNITED STATES.

The magnitude and cost of this work may be imagined when it is mentioned that in 1905 nearly 17,000,000 sheep were dipped under the supervision of Inspectors of the said Bureau, and several times that number were examined and passed as sound. As a result of this work sheep scab has almost entirely disappeared from several States that were badly infected and is much less prevalent in most others.

The Secretary of Agriculture in his annual report for the year 1905 states "that by continuing the work for a few years the disease can undoubtedly be eradicated."

In coöperation with the National Government, the individual States and Territories have endeavored to enforce the Federal regulations and in every way possible to support the work of eradicating sheep scab, and I am pleased to state that the same spirit has prevailed in this Territory.

## DIPPING IN HAWAII.

I have, during the past year, supervised the dipping of many thousands of sheep, the total number of dippings amounting to more than 40,000, with the result that the disease has been practically exterminated on one of the Islands, where formerly it prevailed to considerable extent.

The Island of Hawaii seems to be free from this disease and the same may be the case with Kauai and Niihau, neither of which Islands I have so far had an opportunity to visit.

If the sheep owners on the Islands where sheep scab is known to exist continue the treatment now inaugurated, there is no reason why this disease should not be completely eradicated in the course of a few years.

It is not known at what period sheep scab was first introduced into this Territory, but it no doubt occurred with one of the earliest importations of breeding stock. The conditions in the Islands are not favorable for the spread of the disease. The even climate and the open ranges on which the sheep are allowed to run at will without being herded in flocks—as is done on most of the western ranges on the mainland—all tend to prevent the spread of the disease, and when sheep scab nevertheless became quite prevalent on certain Islands, it was simply due to a lack of the ordinary precautions which were being taken in all sheep raising countries and which now have been established here.

## PUBLICATIONS CONCERNING SCABIES.

There is available a number of excellent publications on the subject of this disease, issued either by the United States Department of Agriculture or by the experiment station of the various sheep raising States in both this and foreign countries, so it would seem unnecessary here to give a description of the nature, cause and symptoms of this disease. Of these publications I shall only mention Bulletin No. 21 of the Bureau of Animal Industry, United States Department of Agriculture, entitled "Sheep Scab, Its Nature and Treatment," copies of which may be obtained upon application, addressed to the Secretary of Agriculture, Washington, D. C.

The Bureau of Animal Industry recommends tobacco-sulphur and lime-sulphur dips as the most effective and economic remedies for this disease, and the lime-sulphur dip has been employed by me in the treatment and prevention of sheep scab during the past year.

## ADVICE AND ASSISTANCE PROFFERED.

It may be well to state here that I am prepared at any time to assist sheep raisers in the Territory with the installation

of dipping tanks, the preparation of the dip as well as with the application of the treatment for preventive or curative purposes. The present high price of both mutton and wool should prove an inducement to all sheep raisers to improve their flocks in every way possible, and the first step in this direction is to rid them of diseases which tend to diminish their yield of either commodity.

### HORN FLIES ON SHEEP.

On the mainland sheep are rarely known to be attacked by the horn fly, but it seems that on some of these Islands where sheep and cattle graze in close proximity to each other, the horn flies frequently leave the cattle to attack the sheep, whenever there are denuded spots on them due to the sheep scab parasite or the screw worm fly. It is also possible that horn flies which hatch after the cattle have left the range, to be followed by sheep, attack the latter simply because there are no cattle in the neighborhood or else they are blown by strong winds from the cattle to the sheep.

I have carefully observed the action of the horn fly on sheep and I do not believe that they are able to penetrate the wool and reach the skin of the unshorn sheep, so long as there are no bare patches present; but wherever sheep scab prevails, or has prevailed, the horn fly has proved a complication of a very serious nature.

### THE ONLY REMEDY.

Even when scabby sheep have been completely cured of this disease through repeated treatments, the horn fly will continue to attack the bare spots, causing the sheep to lick the wounds and prevent their healing, and I see at the present time no remedy for this condition except the complete elimination of sheep with bare spots from the herds. Treatment is of little avail, for even though the sores heal up, the skin continues to be exposed to the attacks until the wool has grown long enough to protect it.

### HORN FLY A SERIOUS MENACE.

The horn fly must, therefore, be considered a serious menace to the wool and mutton industry and would no doubt be so to a far greater extent if it were not for the natural and introduced parasites which attack the pupae of the flies. I would, therefore, suggest that the horn fly question be made a subject of an appeal to the Board of Agriculture by the individual live stock raisers, or the Live Stock Raisers' Association, for the purpose of ascertaining and recording all investigations made in the United States and other countries in regard to the life history, habits, control and eradication of this pest, and that exhaustive experiments be conducted here in the study of the life history, habits and propagation of the already known parasite of the horn fly.

## THE SCREW WORM FLY.

The screw worm is unquestionably one of the most important parasites attacking the domestic animals on the mainland, and, as I have had opportunity to observe it here a few times, it would seem advisable to sound a note of warning now, in order that its limited prevalence in this Territory may not develop into the scourge which it has proved in other countries.

I have, as stated, only seen a few cases of sheep attacked by screw worm, but I am informed by Mr. Francis Gay of Kauai, that this parasite is comparatively common on Niihau.

### FATAL TO MAN.

As the fly has been known frequently to attack man by gaining entrance to the openings of the face, often with fatal results, it would appear that every effort should be made to eradicate this pest from the Islands. The screw worm fly (*Compsomyia macellaria*, Fab.) is common on the American continent from Canada to Patagonia, but the territory within which the greatest damage occurs is within the tropical and sub-tropical belt.

In the United States the fly is most common in Texas where it principally attacks cattle and more rarely horses and mules. The eggs are deposited in any wound or scratch, and the larvae, which develop shortly afterwards, bore into the flesh, causing severe

loss of tissue with inflammation and suppuration, and if treatment is not applied the wound will become infested rapidly with fresh deposits of eggs and the animal, as a rule, dies.

## DESCRIPTION OF FLY—METHOD OF ATTACK.

The fly which causes all this trouble is less than half an inch in length, of a bluish green color, with metallic reflections. It is easily distinguished from other flies by the presence of three longitudinal black stripes on the thorax (chest). The head is reddish or yellow and the body is covered with stiff black hairs.

In order that stock raisers may recognize this fly by its action I shall describe a couple of cases which came under my personal observation here. In the first case the fly had evidently deposited its eggs in the wool on the side of the rump where no abrasion of the skin existed. The maggots, or screw worms, which develop from the eggs within a few hours after being deposited, had attacked the skin, into which they bored holes, causing a severe inflammation which gradually made the wool fall off. At first, however, nothing was noticed except a dark moist spot on the wool about the size of the palm of a hand. In parting the wool at this place it was found that the skin underneath was covered by a wriggling mass of maggots, many of them with their heads deeply buried in the inflamed skin while the protruding parts of the body underwent the characteristic contortions from which the parasite derives the name of screw worm.

The maggots mature in from five to six days when they fall to the ground, where they bury themselves and in the course of ten days to two weeks are transformed into flies.

## CONTINUITY OF ATTACKS.

The severity of the attack depends upon the number of eggs which have been deposited; (at least three to four hundred eggs may be deposited by a single female in a very few moments, and the same fly may at various times and places deposit thousands of eggs).

If all the eggs develop at the same time and the larvae find equal opportunity for development, then they should all have left the host in the course of a week to ten days and the affection of

the skin would have a chance to heal up. But it seems probable that the same fly or other flies are attracted to the already affected place and that they continue to infect the wound by fresh deposits of eggs. That such was the condition in the case here referred to was evident from the appearance of the wound. On the side of the rump was a large bare spot denuded of wool and of a shiny dry appearance. Here and there were seen deep round holes varying in size from a pin's head to a small pea, with sharply defined edges and some of them filled with green pus. In only a few of these holes screw worms were seen, and the whole appearance of this area indicated that the healing process was progressing favorably. Surrounding this area, and also denuded of wool, was a highly inflamed zone where every hole in the skin was filled with a rotating screw worm, and surrounding this again was another zone two or three inches wide, covered with wet, discolored wool, under which could be seen a solid mass of wriggling, newly hatched maggots which had not yet begun to bore into the skin. The whole process and manner of operation of the screw worm in attacking the uninjured skin was, therefore, fully illustrated in this one case.

Where the skin is already broken, the parasite meets with less difficulty and the damage done is much greater. Here they attack the fleshy parts at once and burrow deeply under the skin following the course of least resistance; the putrid emanations from such a wound greatly attract other flies and unless treatment is begun in time the animal dies of blood poisoning or as the direct result of the injuries to vital organs by the maggots.

### ANOTHER CASE.

The second case I observed was of this nature: A large abscess or tumor on the right side of the jaw of a sheep had broken open and became infested with screw worms. The entire mass of the tumor, which must have been the size of a clinched fist, had been eaten away by the maggots, leaving a wound five inches in diameter with ragged, undermined edges and reaching clear through the cheek to the jaw bone.

Where the screw worm attacks the uninjured skin spontaneous recovery may take place, unless the same wound is constantly

reinfested by new deposits of eggs, but in a case like the last one described speedy treatment is required or the animal must die.

### THE SCREW WORM IN TEXAS—DANGEROUS TO CATTLE.

In Texas the screw worm season begins in June or July and reaches its climax in September and October, after which it gradually declines until cool weather puts a stop to it. The adult fly survives the winter in protected places and makes its appearance again the next summer.

As stated, sheep are rarely attacked on the mainland except when injured, nor have I seen attacks upon the uninjured skin reported except from one place.

Dr. M. Francis (Bulletin No. 12, Texas Experiment Station) states: "Of all our domesticated animals cattle suffer the most from its ravages. Sheep are comparatively free from the attacks unless injured by dogs."

Prof. H. E. Weed (Bulletin No. 14, Mississippi Experiment Station) states:

"Sheep are attacked when injured by dogs, or, when the sheep are in poor condition the eggs are laid upon the wool, and when the larvae hatch they immediately bore into the skin."

He adds that in many cases sheep are attacked within the nasal cavaties and the worms eat into the head, but no such cases have been observed here.

### MAN FATALLY INFECTED IN KANSAS.

In an article in the Peoria Medical Monthly for February, 1883, Dr. Joshua Richardson writes under the heading of "The Screw Fly and Its Ravages," as follows:

"While traveling in Kansas in the latter part of last August, a citizen of this place had the misfortune to receive, while asleep, a deposit of eggs from this fly. He had been troubled for years with catarrh, hence the attraction to the fly. He returned home a few days after the accident and shortly after began complaining of a bad cold. His nose seemed greatly swollen and he complained of a smarting, uneasy feeling in it, and general misery through the head. I found on examination a mass of the larvae of this fly (or "screw worm," as they are commonly called in the

South) completely blocking up one nostril. On touching them they would instantly retreat en masse up the nostril. Making a 20 per cent. solution of chloroform in sweet milk I made a few injections up both nostrils, which immediately brought away a large number, so that in a few hours I had taken away some 125 of them. His speech becoming suddenly worse, I examined the interior of his mouth and found that a clear-cut opening had been made entirely through the soft palate into his mouth and large enough to insert the end of a common lead pencil. Saturday the few remaining larvae began changing color and one by one dropped away. On Sunday, for the first time, hemorrhage from both nostrils took place, which continued at intervals for three days, but was not at any time severe. On this day the patient began to improve, the delirium and erysipelas having subsided, leaving but little or no annoyance in his head. In a few days he became able to go about home, and even to walk a distance of half a mile to visit a friend and return. But while there he began complaining of a pain in the neighborhood of his left ear, apparently where the eustachian tube connects with the middle ear. It proved to be an abscess. Being already so reduced by the first attack, he was unable to withstand the second, and died after an illness of nearly three weeks, completely exhausted by his prolonged sufferings. Three days before his death the abscess discharged its contents by the left nostril. The quantity of pus was about 2½ ounces (78 grams).

"In all about 250 larvae were taken away from him during the first attack, and, as the visible results, not only had they cut the hole through the soft palate, but had also eaten the cartilage of the septum of the nose so nearly through as to give him the appearance of having a broken nose. The case occupied, from the first invasion of the fly to its final result, nearly two months. He doubtless would have recovered but for the formation of the abscess, which, from all the symptoms, was caused by one or more of the larvae having found their way up the left eustachian tube."

ATTACKS ARE GENERALLY FATAL.

Dr. Richardson also quotes the Rev. William Dixon, of Green, Clay County, Kansas, as giving the following account of his own experience:

"While riding in his buggy a few years ago in Texas a screw fly attacked him, flying up one nostril. He blew it out, when it dashed up the other and deposited its eggs before he was able to expel it. Not realizing the danger, he did nothing for about three days, when the pain became so great that he hastened to Austin to consult a physician. His soft palate was almost destroyed before the larvae, over 200 in number, were expelled."

This was the only one of twelve cases known to Dr. Richardson in which the patient recovered.

While I do not believe that the screw worm fly is of a recent introduction in these Islands, I feel convinced that powerful agents must be at work here, keeping it in check.

## PRECAUTIONS SHOULD BE TAKEN.

Nevertheless, there is every reason for taking such precautions for its suppression as circumstances will permit.

In the southern parts of the United States this pest has become a perennial nuisance, causing great economic loss and when it is taken into consideration that each female fly lays several thousand eggs and that a number of generations are developed each season, and no doubt would continue to develop uninterruptedly in this Territory, where the winter is not severe enough to check it, except for the destructive agents above referred to, then it will be seen that the destruction of each grown fly and each single maggot will prevent the development of succeeding generations.

## PRECAUTIONS AND TREATMENT RECOMMENDED.

The object should, therefore, be to destroy by fire the carcasses of all dead animals (the maggots develop in these as well as in the living animals) and to submit to speedy treatment all affected animals which come under observation. These should be caught and treated on the spot, or if possible, brought home and dipped.

When treated in the pasture care should be taken to do it in a spot which can easily be disinfected by fire, as the maggots leave the sores immediately and fall to the ground when medicine is applied to them.

The repeated application of a 10 per cent. solution of carbolic

sheep dip, or the dipping for five minutes in a 3 per cent. solution of the same, and repeated after ten minutes, is very effective.

Lime and sulphur dip has no effect on the maggots.

Dr. Francis of Texas recommends the use of creolin, or any of the carbolic sheep dips, to be carried in a machinist's oiler, by means of which it may be injected into deep holes without any waste or squirted on affected surfaces. Such an oiler, holding about four ounces, is carried by nearly every cowboy in Texas during the screw worm season.

## GLANDERS.

This disease is quite prevalent among the horse stock in Honolulu and vicinity. During the past year about forty cases have come under my personal observation or been reported to me by the practicing veterinarians.

It is said that glanders was very common some years ago, both in Honolulu and on the other Islands; but whether all the animals which have been destroyed here, for this disease, were really affected with glanders can, of course, not be ascertained now. That new cases have been repeatedly introduced with importations from the mainland, is a well established fact, and I have personally seen two cases of acute glanders in a shipment of mules from San Francisco which arrived a year ago; and quite recently another case, also in a mule from California, which developed the disease shortly after arrival here, and before the animal had come in contact with other horse stock.

## MALLEIN TEST MADE COMPULSORY.

In order to minimize the danger of introducing new centers of infection with imported horse stock, the mallein test, which is recognized the world over as the best, though not infallable means of diagnosing glanders, was made compulsory for all horse stock before admission to the Territory.

The enforcement of this rule has no doubt proved beneficial in causing greater care to be exercised in the selection of horses and mules for shipment to these Islands, and will tend to discourage unscrupulous dealers from disposing of sus-

picious animals, in the hope that the disease will not become manifest until after arrival and admission to the Territory, as undoubtedly has been common practice before.

## POSSIBILITIES OF ERADICATION.

With this check on the original and continued source of infection there is some hope for the ultimate eradication of this most dangerous of animal diseases, though the prospects of gaining this end in the near future are anything but encouraging.

With the many Orientals and foreign inhabitants, a large number of whom are horse owners or employed by horse owners, whose ignorance in general and lack of knowledge of the American language prove almost insurmountable obstacles to the imparting of information regarding the nature of the disease in question and the danger in handling affected animals, and whose inherent cupidity is supported by actual or simulated ignorance of the rules and regulations promulgated for the suppression of this disease—the odds seem to be overwhelming against a successful issue.

There is a disinclination on the part of this class of people to voluntarily surrender an animal, as long as there is a breath of life left in it, even though the disease has progressed to the point where the living animal is little better than a fetid carcass.

When every known remedy has been applied and when finally the presence of the animal becomes unbearable, there is generally a friend or relative who is willing to try a new series of experiments. When these have proven futile, in either killing or curing, a change of air and surroundings is deemed beneficial, and the victim goes into the country where it may be found, sooner or later, wandering by the road side or temporarily recuperating in somebody else's pasture and scattering the infection broadcast.

## ASSISTANCE OF PUBLIC NECESSARY—COMPENSATION TO OWNERS.

Under these circumstances it is obvious that the individual efforts of a single official count for little, and only the coöpera-

tion of every citizen, whether horse owner or not, in reporting suspicious cases, can at all lead to the desired results.

The practicing veterinarians of Honolulu have been instrumental in the apprehension of a majority of the cases which have been destroyed during the past year, and which, without their assistance, might never have come to notice; but a thorough campaign against this disease cannot be undertaken until the required funds are forthcoming, wherewith to indemnify the owner who promptly reports the first suspicion of glanders and whose animal is destroyed for the benefit of the public in general, as is now being done in many of the States and most foreign countries.

## EFFECT OF CLIMATIC CONDITIONS.

From observations made during the past year I have come to the conclusion that the climatic conditions in these Islands are not favorable to the malignant form of glanders. Rather the opposite seems to be the case.

While a considerable number of very bad cases have been seen and disposed of, many of them were undoubtedly old or chronic cases which, under unfavorable circumstances, would have developed into acute cases, and, as such, would have transmitted the disease to a much greater number of animals.

It frequently occurs that only one or two cases of glanders appear in large stables, where there would seem to be every facility for the spread of the disease; but where, nevertheless, no more cases occur after the diseased ones have been disposed of and ordinary precautions have been taken to check the disease.

## GLANDERS ON HAWAII AND MAUI.

Several small outbreaks among plantation stock on Hawaii and Maui have been reported, but none of them have assumed the proportions which would have been the invariable consequence in other localities with more strongly differentiated seasons. Under such conditions, glanders would undoubtedly have become epidemic here long ago, and the result would have been the early adoption of those sanitary and preventive

measures which are in vogue elsewhere but which seemed to be practically unknown here.

### LITERATURE CONCERNING GLANDERS.

For those who may wish to acquaint themselves with the nature, cause and symptoms of the disease under consideration a circular, entitled "Glanders and Farcy" has been issued by the United States Bureau of Animal Industry and may be had by application to the Territorial Veterinarian, Honolulu.

### CHRONIC NASAL CATARRH IN HORSES AND MULES.

(Pseudo-glanders, Japanese farcy.)

There prevails on all of the Islands, which I have visited, a chronic nasal disease affecting to a considerable extent both horses and mules.

This disease, in its aggravated form, resembles chronic glanders and may indeed be a mild form thereof, though until definitely diagnosed it has been considered advisable to refer to it as chronic nasal catarrh.

*Symptoms:* There is more or less abundant discharge from one or both nostrils. This may be either thin and watery, syrupy and sticky, or in advanced cases thick and straw-colored, and forming crusts around the nostrils. It is frequently mixed with blood, assuming the appearance of typical glanders discharge. It may persist for months or even years, and by its constant irritation of the mucous membrane causes the appearance of erosions or superficial ulcerations, which, however, lack the thick indurated edges of the typical glanders ulcerations. These erosions form principally on the lower part of the partition which separates the nasal chambers, (the septum nasi) and in order to observe them it is necessary to turn the head of the animal toward the sun, raise the head and open the nostrils as far as possible to admit the light.

When the discharge is scant the erosions may be absent, but we observe in their place round or irregular thickened patches of a greyish or brown color with granulated surface, and protruding slightly above the level of the mucous membrane. Or

we may find white stellate cicatrices greatly resembling the scars resulting from glanders ulcerations.

The submaxillary lymp glands (glands the size of beans or hazelnuts, located just beneath the skin and between the branches of the lower jaw) may be swollen or not, but are rarely attached to the bone as is almost always the case in glanders.

### SYMPTOMS CONNECTED WITH THE EYE.

Another condition which frequently accompanies this disease is conjunctivitis of either one or both eyes. The mucous membrane of the eye is red and swollen. There is more or less discharge of tears and the swollen eyelids are kept half closed giving the animal a sleepy appearance. This condition is not always present but is most frequently seen when the discharge from the nose is abundant. It is more common in young than older animals.

The affected animals seem to suffer very little inconvenience from the disease in its mild form, which is by far the most prevalent. If food is abundant they remain in good condition and are able to perform their work satisfactorily.

A large number of cases recover spontaneously under favorable conditions, exhibiting only the white scars in the nose; but whether the cure is permanent or only temporary has not yet been ascertained.

Animals are known to have suffered from a rather aggravated form of the disease for years, and still remained in good flesh. One saddle horse, for instance, came under observation, which the owner disliked to ride because it invariably snorted blood-stained mucous over him when ridden against the wind. This condition was known to have persisted for six years. Otherwise the symptoms, principally the nasal discharge, seem to abate or increase in accordance with the prevailing climatic and food conditions.

With plenty of feed and little work there is a strong tendency to recovery, while a drouth and consequent scarcity of food aggravates the symptoms.

## IMPORTANT THAT THE DISEASE BE STUDIED.

Whether the disease may be transmitted from animal to animal has not been definitely decided, though everything points toward the infectious nature of it, and it is to be hoped that means will soon be provided for the study of this very important point. So far, experiments have shown that the disease is not easily transmitted to donkeys, but it is possible that these animals may be immune.

On post-mortem examination it is found that the lesions in the nose, whether fresh erosions or old scars, are principally confined to the lower one-third of the septum nasi, while in typical glanders the ulcerations appear to be more common on the upper part and to spread from there downwards.

In the lungs there are invariably found a greater or less number of calcareous nodules, possibly due to parasites, but also fresh nodules with a yellow center surrounded by a purplish hemorrhagic zone and very much resembling the nodules observed in true glanders.

## MALLEIN TEST—ADDED NECESSITY FOR LABORATORY.

When to the above description is added that twenty per cent. of all of the affected animals I have tested with mallein have given more or less pronounced reactions, (twenty-seven reacted out of one hundred and thirty-four head tested,) it will be seen that the parallelism between the symptoms and post-mortem lesions of the disease in question and those of a mild form of chronic glanders is so pronounced that a diagnosis cannot be made without a thorough pathological and bacteriological examination, the facilities for which, as stated, are not, at the present time, at my disposition.

## DISTRIBUTION AND ECONOMIC IMPORTANCE.

At the request of Messrs. C. Brewer & Company I undertook during October and November of last year an investigation to determine the prevalence of glanders on the Island of Hawaii. In this work I was assisted by Mr. Julian Monsarrat, manager of the Kapapala Ranch, who accompanied me on the entire trip around the island, and to whose knowledge of the

language and local conditions is principally due the important results of the investigation.

I am also indebted to the Volcano Stables and Transportation Company of Hilo for furnishing free transportation for Mr. Monsarrat and myself during the entire tour, occupying more than a month's time; also to the various plantation and ranch managers, and to the local police authorities for rendering every assistance possible in furthering the investigation.

## NUMEROUS EXAMINATIONS ON HAWAII.

It is not my intention here to give a detailed description of this work, but simply to state that a total of nearly 4000 animals were examined, 137 head were tested with mallein and 27 head were destroyed, with the owners' consent, and for post-mortem examination. Of the total number examined 727 belonged to plantations. (It should be stated that in the case of the plantations, only such animals were clinically examined as either the managers or lunas requested to have examined, or which they suspected to have been exposed to the infection.) Of these only thirty-eight showed more or less pronounced symptoms and those which reacted to the mallein test were destroyed. This comparatively small percentage of plantation animals affected, would seem to indicate that stabling, feed and care, as afforded this class of animals, have a decided effect in keeping the disease in check, especially when considered in connection with the following statement.

## DISTRIBUTION OF DISEASE.

On the same plantations a large number of the foreign laborers keep a horse or two for their private use, the employers generally providing pastures for these animals. Nearly 1700 head of horses and mules of this class, generally undersized and cheap ponies of island breeding, were examined, and of these 458 head were found to be affected, or more than twenty-five per cent.

The greater number of the affected animals had the disease in a very mild form, which may be accounted for by the fact that they were, with few exceptions, in good condition as to flesh, had

little or no work to do and an abundance of food. Of most interest, however, was the distribution of the disease.

On some plantations not a single case was found, either among the plantation stock or among the animals belonging to the laborers, while on a neighboring plantation twenty-five to fifty per cent. of the latter class would be affected with scattering cases among the plantation stock. These cases would most frequently be among horses and mules which came much in contact with the laborers' animals, as, for instance, store wagon horses, or such as were used on the public highways and which came in contact with Japanese stage horses, many of which were affected. In the same way it was found that where a laborer owned more than one animal, the rule was, that either all of them were affected or else none of them.

These circumstances all point toward the infectious nature of the disease.

## DISEASE ON RANCHES.

The horse stock on the ranches which were visited also appeared to be affected to a considerable extent. As it was out of the question to gather and inspect all horses on the ranches, only a few head from each pasture or range were submitted to examination. Out of a total of 443 head thus examined 102 were found to be affected, or twenty-three per cent.

In certain sections where a drouth had prevailed for many months, practically every animal was affected, while on other ranches under more favorable conditions only scattering cases were found.

On one ranch in the southern part of the Island where about one hundred head were examined not a single case was found. This is so much more remarkable as the disease was quite prevalent on the neighboring ranches on both sides, with identically the same climatic conditions.

## THE DISEASE ON OTHER ISLANDS.

As a considerable number of horses are shipped from Hawaii to the other Islands, principally to Maui, it became of interest to know if this nasal disease was found on the other Islands, and if so, to what extent. The Island of Maui was therefore visited and several hundred horses were rounded up and examined. It was found that the disease prevailed to practically the same extent among the animals belonging to the plantation laborers there, while not a single case was found on the Haleakala ranch, where every animal was examined. Since then I have observed the disease on Molokai, Oahu and Kauai, on all of which Islands it is quite common, though to a less extent than on Hawaii and Maui.

## CONCLUSIONS CONCERNING THIS DISEASE.

The disease in question, whether simply a chronic nasal catarrh or whether due to a specific cause, (infection), cannot at the present time be considered of great economic importance, except in so far as it diminishes the value and prevents the sale of affected animals.

The constant snorting and emission of the discharge makes it a nuisance to either ride or drive the affected animals, but no case of transmission of the disease to man has come under observation.

The working capacity of the affected animals is but slightly impaired and no death as the direct result of the disease has been known to occur.

Whether under continued unfavorable conditions the disease might develop into a more virulent type has not been fully demonstrated, though observations made on certain ranches on Hawaii indicate that such might be the case; but until the true nature of the disease has been ascertained no definite conclusions can be made as to measures to be adopted in dealing with it.

## SEGREGATION OF ANIMALS RECOMMENDED—TREATMENT.

In the meantime it would seem advisable to separate the affected animals,—that is to deal with the disease as if it were known to be infectious.

Plantation managers should, as far as possible, prevent all intercourse or contact between the animals belonging to the laborers,—a large percentage of which are affected,—and the plantation stock, and if any of the latter are affected their noses should be washed regularly with a disinfecting solution and they should be placed in the stables where they cannot blow the discharge on other horses, and should be watered from separate troughs.

If aged and affected with chronic blood-stained discharge they should be destroyed, and it should constantly be borne in mind that animals suffering from this disease are highly susceptible to any infection, through the inflamed nasal mucous membrane, and that cases of true glanders may easily be obscured or pass unnoticed for a long period, where many animals are suffering from chronic discharge from the nose. All such animals should therefore be examined regularly for deep or eating ulcers in the nose, which, as a rule, are easily distinguished from the more superficial erosions which characterize the disease under consideration, at least when they occur on the lower part of the septum.

### TUBERCULOSIS.

I am pleased to report that my observations during the past year justify me in stating that tuberculosis is a comparatively rare disease in these Islands. A few cases are known to have occurred among range stock on Kauai, no doubt introduced and transmitted by imported breeding stock, but beyond these I believe the disease to be very rare among Island-bred stock.

In former years animals brought here for dairy purposes were frequently affected with tuberculosis and the disease undoubtedly lingers in a number of dairy herds as a result thereof.

With the precautions which now have been taken to prevent the further introduction of affected animals it should not be difficult to eradicate the disease entirely from the dairy herds of the Territory, and I feel convinced that the climate and the manner of keeping stock in open stables, when they are not in pasture, all tend to retard or prevent the spread of the disease.

It is expected during the coming year that measures will be adopted for the testing with tuberculin of all dairy herds from which milk is sold for human consumption, and that all such dairies and animals be submitted to regular inspection by competent men, under regulations promulgated by the Board of Agriculture in coöperation with the Territorial Board of Health.

# DIVISION OF AGRICULTURE.

## Report of Mr. Jared G. Smith.

Honolulu, Oahu, Jan. 15, 1906.

Board of Commissioners of
Agriculture and Forestry,
Honolulu, Oahu.

Dear Sirs:—I beg to submit herewith a statement of the expenditures under the appropriation for "Assistance to Federal Experiment Station," during the calendar year ending Dec. 31, 1905, together with a brief account of some of the results of the season's work with tobacco in Hamakua.

A more detailed account will be published as a Press Bulletin of the Hawaii Experiment Station.

Respectfully,

JARED G. SMITH,
Special Agent in Charge,
Hawaii Experiment Station.

### EXPENDITURES.

The expenditures for "Assistance to Federal Experiment Station" under the Board of Commissioners of Agriculture and Forestry during the calendar year ending Dec. 31, 1905, have amounted to $2,957.73. Of this amount $1,762.23 was used for the tobacco experiments in Hamakua, County of Hawaii, and $1,195.50 for white labor at the Hawaii Experiment Station, Honolulu.

### TOBACCO.

Two acres were planted to this crop in 1905, one acre more than during the previous year. To care for the larger crop

the curing barn was enlarged by a 40x30 foot addition, 18 feet high to roof plates; and, a fermenting room with tight walls constructed 8x16 feet, 8 feet high,—a lean to against the makai wall of the tobacco barn. New seed beds were also constructed, using cloth that remained from the tenting experiments of the year 1904 and old lumber.

Three laborers have been employed, one man and two women, at an average cost of $40.00 per month. Laborers' wages have been paid from Federal funds. The Superintendent, Mr. C. R. Blacow, has received a salary of $130.00 per month.

The Louisson Brothers of Honokaa, Hawaii, assisted us by paying for the clearing and plowing of the additional plot of land used for the experiment.

Although the tobacco barn was enlarged, it is still inadequate to properly care for the whole crop, and considerable loss was encountered through pole burn induced through overcrowding. It is planned to further enlarge and change the construction of the barn during the coming season. The whole crop was grown in the open, *without shelter or tenting.*

The bulk of the 1905 crop was of the Cuban types.

The Cuban type seed was Hawaiian grown except an importation of Partidos and one of Vuelta Abajo direct from Cuba, through the courtesy of the Secretary of Agriculture, Washington, D. C.

The varieties of the Cuban type were: Partidos; Vuelta Abajo; Hamakua seed leaf; No. 56; Zimmer Spanish; Comstock Spanish; Connecticut seed leaf; and Pennsylvania seed leaf.

Of the Sumatra type there were: Hilo leaf; Manila; Japanese; and Hawaiian.

The season of 1905 was a very favorable one and the tobacco is all of much better quality than in 1904. The cure and color also show great improvement.

Samples of the 1904 crop were widely distributed and received much favorable comment, in spite of the fact that it was not properly cured and was largely overripe when harvested. I had 14 boxes of cigars made up by Lee Toma & Co., Honolulu, and gave them around for trial. Some of these cigars

were very good and some were very bad. There was not enough of the tobacco to grade to color or quality.

The 1905 crop is not yet completely cured. Mr. Blacow has carried one lot through the fermenting bulk and is now finishing up the balance.

The tobaccos which show great merit are: Hamakua seed leaf, a seed selection from Comstock Spanish stock; No. 56, a seed selection from imported Cuban seed; Hamakua leaf, a selection from imported Deli, Sumatra; and Pennsylvania seed leaf, purchased through a seed dealer in Philadelphia. The latter is the only one not grown one year previous in Hamakua. Mr. Blacow has done very valuable work in selecting plants for seed, the results of which already show.

*Hamakua Seed Leaf.* This is planted for domestic wrappers; larger than the typical Cuban and yielding 50% more crop per acre. About 35% of the crop cured in light colors, suitable for wrappers. The texture is silky, elastic; veins small, thin and with a good body. The best quality wrapper is worth from 35 cents to 70 cents per pound.

Another 30%, too dark for wrapper but of the same texture, is prime binder, worth 25 to 45 cents per pound. The remaining 35% is domestic filler of good quality, worth 8 to 12 cents. The yield of plant crop is about 1000 pounds per acre. A second or ratoon crop yielded smaller leaves of fair to poor texture, fully 50% light colors, salable as filler and binder, about 500 pounds worth 8 to 15 cents. A crop of Hamakua seed leaf should yield about 1400 pounds of cured tobacco worth $300.00.

*No. 56.* This plant was selected for thinness of leaf, stocky growth and large number of medium to small, rounded leaves. The crop from seed plant No. 56 has been pronounced by experts similar to the best imported Vuelta Abajo leaf, and better than the average mainland grown "Havana." Unfortunately the color of the cured leaf runs dark, but in size, shape, texture, grain and burning qualities the crop from this selection approaches perfection. The light wrapper amounted to about 10%, worth 70 cents to one dollar per pound. Fifty per cent. was prime binder and filler, worth 35 to 50 cents,

and the remaining 40%, including torn and bottom leaves, top leaves and culls would sell as filler at 10 to 15 cents. The yield of No. 56 amounts to about 900 pounds per acre. If sorted, graded and packed in Cuban packages the best wrapper would bring high prices, but a large acreage would be necessary to produce quantity from which to select. The leaf has the same dull rich colors and hairiness as the imported article. Color is largely a matter of manipulation in handling and can be controlled. Texture and burning qualities are factors controlled by the soil and climate. We believe that No. 56 is capable of development into a perfect Hawaiian type of Cuban wrapper tobacco. Selections have been made again this year and we hope to improve the quality of next year's crop.

*Pennsylvania Seed Leaf.* This is a stocky, medium tall plant with enormous leaves. The cured leaf is of even, warm colors, running 20% light; small side veins; good texture, thin and elastic. About 5% on account of thinness and elasticity with light color is suited for the best grades of domestic wrapper. Fully 50% is binder worth 20 to 40 cents; and, the balance domestic filler or manufacturing tobacco worth 8 to 12 cents. The burn of this leaf is good. The yield is about 1400 pounds per acre, worth from $225 to $300 per acre. An attractive feature of this tobacco is the large yield. It cures well and is of remarkable uniformity in color and texture, showing careful selection in the development of the type.

These three Cuban types showed marked adaptability to Hamakua conditions. Others which were more or less unsatisfactory are *Zimmer Spanish*, a very dark, heavy leaf suited only for manufacturing purposes; *Vuelta Abajo*, a very thick, heavy, dark leaf with good burning qualities, but only suited for domestic filler and pipe tobacco, rather strong and leaves larger than they should be; *Partidos*, this was so unlike the genuine Cuban Partidos wrapper, which is the best light wrapper grown anywhere in the world, as to cast doubt on the seed having come from that district. Partidos wrapper is characterized by extreme thinness and light colors. Green spots are a feature of the cured leaf.

Several other types of domestic cigar tobaccos were grown but none showed desirable qualities, and are not worth discussing here.

The *Sumatra* type of tobacco is apparently a race distinct from the *Cuban*. The so-called "native Hawaiian tobacco" is of this type and was undoubtedly first brought here from the Orient, rather than from the West Indies or Mexico. The *Manila, Java, Sumatra, Hawaiian* and *Japanese* tobacco are apparently all of one stock. The plant is tall, from 6 to 10 feet high, inclined to branch; leaves very many, the petioles usually with wings decurrent along the main stalk. The cured leaf is smoother than the Cuban, devoid of the hairiness that characterizes the latter.

Our Sumatra was originally of six or seven different types, from which a few selections have been made towards establishing a variety with broad leaves rounded at base and tip and the requisite thinness and elasticity. It will require careful selection for a number of years to fix the desirable characters and develop a leaf suited to Hawaiian conditions. The 1905 crop is much better than that of 1904 in every way.

A German cigar manufacturer who is well acquainted with the European market, visited the Station and examined our 1905 Sumatra. He pronounced the best of it equal to the imported article, and stated that in his opinion, it could be marketed in Amsterdam as Sumatra leaf. The colors run light, and not much is left to be gained in texture and body. Not over 1% of the 1905 crop is of first quality, worth $3.50 to $5.00 per pound. About 20% is salable as wrapper, worth from 40 cents to $2.50 per pound. A mainland manufacturer who examined it said that 10% of the crop would sell as imported Sumatra for from $1.50 to $2.00 per pound, and that if we could give light colors it would be worth more. The yield of Sumatra tobacco ranges from 1000 to 1800 pounds per acre. All that is not salable as wrapper is worth only a low price, perhaps 10 cents per pound, as an average. A yield of 1000 pounds per acre worth $150.00 to $500.00 or more per acre renders the cultivation of Sumatra tobacco very attractive. The high duty on wrapper of this class, ($1.85 per pound),

makes the production of light wrappers a very profitable enterprise; but the growers must work to produce only wrapper. It is going to be a matter of careful breeding and selection and of very careful manipulation in the curing and fermentation processes, and will require a much larger expenditure of funds than are now at our disposal.

*Japanese* tobacco is an enormous plant, often 10 or 12 feet high. In quality the cured leaf is much like the Sumatra culls. Practically none of it is suited for wrapper.

*Manila.* Our 1905 crop is of good color and flavor and has been pronounced good by experts. The colors run brighter brown than in the Sumatra. As little is to be gained from growing this type commercially in Hawaii we shall not plant much of it in 1906. But it is proved that if any one wishes to do so, Manila tobacco of good flavor can be grown in Hawaii.

*Hawaiian.* The native tobacco is too well known to require description. Its chief characteristics are its deadliness when smoked by the white man, and its poor burning qualities. The local prices for Hawaiian leaf are high and the market limited, it being used only by the Hawaiians and Chinese. As a matter of curiosity mainly, we have grown two crops of this forty-rod tobacco and find that fermentation in the bulk reduces its strength and improves the burn. Its development as a commercial crop is a future possibility, but hardly a probability.

The experiments in Hamakua have demonstrated that tobacco of excellent quality and superior burn can be grown. The commercial possibilities are yet to be demonstrated through field cultivation on a larger scale than our mere plot experiments. A number of experts have examined our 1905 crop, and while all say that there are improvements that can be made, especially in the color of the finished article, all unite in the opinion that our tobacco has superior merit.

In order that the general public may prove the point by personal observation, I have sent 150 pounds of Hamakua tobacco to a mainland manufacturer to be made into cigars, a portion of which will be offered for distribution, and a portion for sale by local cigar dealers. "The proof of the pudding is in the eating thereof."

Another year's trial with a ten acre field instead of a dozen small observation plots ought to settle, and we hope in the affirmative, the question of whether tobacco can be grown on a commercial scale in Hawaii.

## HORTICULTURAL AND FIELD WORK.

### CITRUS FRUITS.

Citrus fruits have long been in these islands and some of the species have shown a marked adaptability to Hawaiian soils and climate. To assist and encourage the further cultivation of these, this Station has prepared during the year Bulletin No. 9 on "Citrus Fruits in Hawaii." This gives cultural instructions relating to soils, propagation by seeds, budding and grafting, irrigation, fertilizing, pruning, etc. Attention is also called to some of the very excellent seedling varieties of Hawaiian oranges. Since the preparation of the bulletin other noteworthy forms have been observed. In at least one instance an orange has been noticed having a decided tendency to the navel type. Two oranges received from Kona, Hawaii, showed this tendency in different degrees. They may have come from the same or from different trees. In the one case there was a destinct miniature orange within the fruit at the upper end, but unlike that in most Bahias or Washington Navels, this was completely inclosed within the rind of the large fruit. In other respects it did not resemble the Bahia. In the other case mentioned the smaller orange within the larger was the full length of that fruit and consisted of distinct, elongated, fleshy and juicy segments which contained seeds. Curiously enough some of the segments of the outer orange also contained seeds.

It should be remembered in this connection that the Bahia or Washington Navel has not been the only discovered representative of this type. The Australian Navel has been known and cultivated for many years, and other forms have in fact been described during more than two hundred years.

There is a practical bearing of this subject upon Hawaiian Citrus culture. Careful breeding from such forms as de-

scribed above would probably produce a seedless Hawaiian orange better adapted to local conditions than any of the navel oranges that have been introduced. Both the Washington Navel and the Australian Navel appear to be of quite local adaptability. The latter is of little value anywhere in America, and the former, which has proved eminently successful in California, can not be said to be a general success in Florida. While there are certainly in Hawaii home-grown oranges which excel in flavor and juicyness any which are imported, it would be a distinct advance from the market standpoint to eliminate the seeds.

The nursery of different species of Citrus established at the Station for purposes of testing varieties and stocks, and for experimental work in general, is making a very satisfactory growth.

## THE MANGO.

The mango promises to be one of the important tropical fruits of the great American markets. This is a fruit which cannot be grown on the mainland except in the extreme southern portions of Florida, but by long test it has been shown to be peculiarly adapted to cultivation in Hawaii. The cultivation of this fruit should be one of the coming horticultural industries of these islands. The Station has therefore deemed it best to give considerable attention to the subject to determine the most desirable varieties and propagate the same for distribution and to experiment with different methods of propagation and of general treatment. Several of the most noted varieties from India have been introduced through the Section of Seed and Plant Introduction in Washington, and others will be forwarded to the Station during the coming season. Those already here have made a good growth and can soon be multiplied. Many of these Indian varieties which are propagated by graftage are far superior to the mangoes now grown in Hawaii from seed, both in point of flavor and texture. Some of them also are extra early and others extra late, thus extending the mango season over many months.

The mango nursery has done well during the year and many of the trees are now ready for experimental work in budding

and grafting. The nursery has been extended by several hundred seedlings during the last season and many plants have also been grown in pots and are to be used in multiplying the best varieties by inarching.

A disease of the mango affecting the fruits, flowers and young twigs has been observed in the islands for several years. Its effects are most noticeable at the time when new growth is starting and when the trees are in flower. These young and delicate parts are turned completely black if the attack is severe and the tree fails to produce fruit or make a desirable growth. The disease, due to a fungus which has been determined by the mycologists of this Department at Washington as belonging to the genus *Colletotrichum*, is most prevalent during rainy weather. Experiments have been conducted by the Station in controlling the disease by means of Bordeaux Mixture with very satisfactory results. At the suggestion of the Station the same remedy has been applied at the Moanalua gardens and has been reported equally effective.

The cropping of the mango is somewhat irregular. Careful observation of the trees and their behavior throughout the season has suggested the probability that much can be done to control this irregularity by judicious irrigation. A bulletin has been prepared during the year on "The Mango in Hawaii," which embodies the results of these and other investigations with this fruit tree.

## BANANAS.

The experiments mentioned in last year's report have been continued through the year. The collection of varieties now numbers upwards of forty at the Station, and quite a number of kinds also are growing at the experiment plots under the Station control at the Hilo Boarding School.

The Bluefields or Jamaica variety, which were introduced by the Board of Agriculture and Forestry, have made an exceptionally fine growth both in Honolulu and in Hilo, about one hundred and forty off-sets having been planted at the Hilo Boarding School lands. Several hundred off-sets are now ready for distribution.

The introduction of this variety promises to be of great importance to the banana industry of the Territory. The plant appears to be well adapted to Hawaiian conditions. It has several advantages over the Chinese or Cavendish variety, which is now the only one grown commercially in the Islands. It can be handled without wrapping, thus reducing the cost of production by about five cents per bunch for labor and material, as well as making a further reduction in the space occupied in the ship. Improper wrapping with damp material has been the cause of very material losses in transit. A further advantage lies in its being apparently less susceptible to the Banana Anthracnose, a common disease due to the fungus *Glocosporium musarum*, Cke. and Massee. In the case of fruits nearly full grown the fungus first attracts attention by black spots on the otherwise green or yellow rind. These spots increase in extent and greatly mar the appearance of the fruit. In the case of younger fruits the disease may destroy the bunch completely. A variety, therefore, which has a degree of resistance, is much to be preferred.

It should further be remembered that the Bluefields or Jamaica is the variety which has the market in most parts of America. The people know this variety and are attracted by its fine form, coloring and aroma.

## CACAO.

The Cacao at Hilo has had a severe test because of the unusually dry weather since it was planted. Notwithstanding this, some of the trees have made quite a satisfactory growth. Most of the trees were of necessity transplanted once, which is not a desirable practice in the case of Cacao except it be from a pot or other container from which it can be removed without disturbing the roots. A further importation of seeds from Samoa will be made in the near future, which will be planted in their permanent position. Through the Section of Seed and Plant Introduction of this Department the Station is to receive pot-grown plants of the best varieties from many cacao-growing countries.

## VANILLA.

A small vanilla experiment plot has been prepared upon which over fifty cuttings have been planted and are doing well. These vines are intended in part as a means to study a disease which has recently manifested itself in the Islands.

## ROSELLAS.

A small piece of land has been devoted to the growth of the Roselle or Rosella, *Hibiscus sabdariffa.* This plant produces in abundance fruits of about one and a half inches in diameter with a fleshy red calyx or flower cup which is used in the manufacture of jam and jelly. The seed vessel itself, while young and tender, is also used in the same way. The fruits met with much favor with a local manufacturing concern.

## THE AVOCADO.

A small orchard of Avocados has been planted, consisting of between sixty and seventy trees. These will be budded to the best available varieties. A very limited amount of work has been done at the Station in budding the Avocado, but up to the present no difficulty has been experienced in ordinary shield budding.

## RUBBER.

Press Bulletin No. 13 on "Rubber in Hawaii," has been published, giving a statement of the character, relative value and probable adaptability of different species of rubber-producing plants for Hawaii. On the upper part of the Station property, lands have been prepared for the planting of a few thousand Ceara rubber seeds for experiments, including fertilizing tests.

## COFFEE.

The ground has been prepared for the transplanting of about one thousand coffee trees which have been grown from selected seed.

## WORK OF CHEMIST.

A portion of the time of the chemist of this Station has been devoted to the analysis of Hawaiian forage plants, both wild and cultivated. Analyses of eighty samples are to be published as Bulletin No. 13 of this Station, which is now in press.

In addition to the usual analysis to determine feeding value, determinations were made of potash, phosphoric acid and lime ash ingredients which are not usually included in fodder analyses.

From these latter figures it was ascertained that many of our fodders are deficient in lime and a summary of the results obtained, together with a general statement as to the value of lime in feeding, has been published in Press Bulletin No. 15..

Dr. Norgaard, the veterinarian of the Board of Commissioners of Agriculture and Forestry, had at the same time arrived at the same conclusions regarding the deficiency of lime from a study of cattle fed on such forage.

This work will be continued in conjunction with Dr. Norgaard, who has already rendered valuable assistance in furnishing samples for analysis.

JARED G. SMITH.

# PUBLICATIONS FOR DISTRIBUTION.

## BOARD.

Report of the Commissioner of Agriculture and Forestry for 1900; 66 pp.
Report of the Commissioner of Agriculture and Forestry for 1902; 88 pp.
First Report of the Board of Commissioners of Agriculture and Forestry, from July 1, 1903, to December 31, 1904; 170 pp.
Second Report of the Board of Commissioners of Agriculture and Forestry, 1905; 240 pp., 8 plates, 10 text figs.
"Notice to Importers," by E. E. Cooper; 4 p.; 1903.
"Digest of the Statutes Relating to Importation, Soils, Plants, Fruits, Vegetables etc., into the Territory of Hawaii." General Circular No. 1; 6 pp.
"Important Notice to Ship Owners, Fruit Importers and Others. Rules and Regulations Prohibiting the Introduction of Certain Pests and Animals into the Territory of Hawaii." General Circular No. 2; 3 pp.; 1904.

## DIVISION OF ENTOMOLOGY.

"The Leaf-Hopper of the Sugar-Cane," by R. C. L. Perkins. Bulletin No. 1; 38 pp.; 1903.
*"On Some Diseases of Cane Specially Considered in Relation to the Leaf-Hopper Pest and to the Stripping of Cane," by R. C. L. Perkins. Press Bulletin No. 1; 4 pp.; 1904.
"A Circular of Information," by Jacob Kotinsky. Circular No. 1; 8 pp.; 1905.
"The Japanese Beetle Fungus," by Jacob Kotinsky and B. M. Newell. Circular No. 2; 4 pp., cut; 1905.

## DIVISION OF FORESTRY.

*"Forest and Ornamental Tree Seed for Sale at Government Nursery." Press Bulletin No. 1; 3 pp.; 1905.
"Suggestions in Regard to the Arbor Day Tree Planting Contest." Press Bulletin No. 2; 7 pp.; 1905.
"An Offer of Practical Assistance to Tree Planters." Circular No. 1; 6 pp.; 1905.
"Revised List of Forest and Ornamental Tree Seed for Sale at the Government Nursery." Press Bulletin No. 3; 4 pp.; 1906.

## DIVISION OF ANIMAL INDUSTRY.

"Inspection of Imported Live Stock." Rule 1; 1 p.; 1905.
"Inspection and Testing of Imported Live Stock for Glanders and Tuberculosis." Rule 2; 1 p.; 1905.
"Concerning Glandered Horse Stock in the Territory." Rule 3; 1 p.; 1905.

*Out of Print.

**Any one or all of the publications listed above (except those marked *) will be sent to residents of this Territory, free, upon application to Mailing Clerk.**

P. O. BOX 331, HONOLULU.

UNIV. OF MICH.
APR 18 1907

ISSUED FEBRUARY 28, 1907.

# THIRD REPORT

OF THE

# BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY

OF THE

# TERRITORY OF HAWAII.

FOR THE YEAR ENDING DECEMBER 31, 1906.

HONOLULU:
HAWAIIAN GAZETTE CO., LTD
1907.

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# BOARD OF AGRICULTURE AND FORESTRY

## FOREST AND ORNAMENTAL TREE SEED AND SEEDLINGS FOR SALE AT THE GOVERNMENT NURSERY.

**The Division of Forestry keeps constantly on hand at the Government Nursery, seed and seedlings of the important native and introduced trees. These are sold at prices just covering the cost of collection or growing.**

**The list includes both forest and ornamental trees, such as Silk Oak, Koa, various species of Eucalyptus, Golden and Pink Showers, Pride of India, Poinciana, Albizzia, etc. The price of the seed varies from 10 to 50 cents per ounce. The seedlings may be had for 2½ cents each, except a few kinds which are 5 cents. Seed of the various palms is also for sale; the price per 100 varying from $1.00 to $2.50. All seed is tested before being sent out, which insures its being good.**

**All communications in regard to seed or trees should be addressed to David Haughs, Forest Nurseryman, Box 331, Honolulu, Hawaii.**

**RALPH S. HOSMER,**
**Superintendent of Forestry.**

## NOTICE FROM THE DIVISION OF ENTOMOLOGY.

The Entomological Division of this Board wishes to inform Hawaiian readers of this report that it is always ready and anxious to receive, study and report upon any insects that they may find and submit. When feasible either colonies of beneficial insects will be sent, or simple, inexpensive remedies will be prescribed. No charge.

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1907.

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OF

# THE BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY

1907

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In coöperation with the Hawaii Experiment Station,

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MISS MELIKA PETERSON

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## EDITOR, FORESTER AND AGRICULTURIST

LEOPOLD G. BLACKMAN

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# BOARD OF AGRICULTURE AND FORESTRY.

## Report of the Commissioners.

To the Governor of Hawaii:

The Board of Commissioners of Agriculture and Forestry presents herewith the report of this Bureau for the year ending December 31st, 1906.

### LEGISLATION.

#### FOREST RESERVES.

Attention is again called to the advisability of amending the present law which permits the setting apart only of unleased Government land or of that on which the lease has not more than two years to run so that the Governor would have authority, with the approval of a majority of this Board to set aside all Government lands within the forest reserve boundaries, those being held under lease to actually become a part of the reserve as soon as they revert to the Government. Under these conditions private owners of lands adjoining, as well as of those to be taken into the reserve would be fully informed as to the policy to be adopted by the Government relative to public land set aside for forestry purposes.

#### FOREST FIRES.

At the last session of the Legislature a bill was introduced providing a special fund for extinguishing fires on Government lands or property immediately adjacent thereto where the spreading of the fires might do much damage to the forest reserves. Any money so appropriated was to be expended by this Board only with the consent and approval of the Governor.

While it is fortunate that no fires of large extent have occurred during the past year, it is important that the Board of Agriculture and Forestry should be provided with sufficient funds to properly protect the forest reserves and other large tracts of Government land in the future.

## MEETINGS OF THE BOARD.

The Board has, during the year 1906, held ten regular and two special meetings, while the members of the various Committees have consulted frequently and submitted numerous recommendations.

Seven joint meetings have been held with the Governor as provided by the Territorial Laws affecting this Bureau for the purpose of ascertaining public opinion in regard to the setting aside of certain forest reserves.

## RULES AND REGULATIONS.

The following rule and regulation appertaining to the importation of rice has been adopted by the Board:

*Rule and Regulation by the Board of Commissioners of Agriculture and Forestry Concerning the Importation of Rice.*

The Board of Commissioners of Agriculture and Forestry hereby makes the following rule and regulation:

Sec. I. For the purpose of preventing the introduction into the Territory of Hawaii of insects, their larvae or pupae, injurious or liable to become injurious to rice either growing or stored, all persons, companies and corporations are hereby prohibited from introducing or importing into the Territory of Hawaii or into any of its ports, any rice infested with such insects.

Sec. II. If any rice infested with insects, their larvae or pupae, injurious to rice either growing or stored, shall be imported or introduced into the Territory of Hawaii or into any of its ports, the same shall, in the discretion of the Board of Commissioners of Agriculture and Forestry, or its duly authorized agent, officer or inspector, be immediately destroyed or deported at the expense of the importer or intro-

ducer, and the person or persons or corporation introducing or importing the same shall be guilty of a misdemeanor and shall be liable to the penalty or penalties provided by law.

Sec. III. This regulation shall take effect from and after the approval thereof by the Governor.

## PUBLICATIONS.

Press Bulletins have been prepared by the Division of Forestry and given wide circulation, as follows:

Press Bulletin No. 3. Revised list of forest and ornamental tree seed for sale at the Government Nursery—4 pp.

Press Bulletin No. 4. Instructions for propagating and planting forest trees—4 pp.

## DIVISION OF FORESTRY.

Mr. Ralph S. Hosmer has continued as Superintendent of the Division of Forestry, the rest of the regular staff including Mr. David Haughs as Forest Nurseryman, being the same as last year.

During the summer months, the services of Mr. Charles S. Judd of Yale University, School of Forestry, were secured and he carried on certain investigations as Special Forest Agent in the planted forest at Lihue, Kauai. It is expected that a bulletin will soon be issued giving the results of his work.

There have been several changes made among the District Foresters, it having been found advisable to divide some of the larger districts into smaller areas. A number of new Fire Wardens have also been appointed. Revised lists showing these officers and the districts in which they serve are included in the report of the Superintendent of Forestry.

## FOREST RESERVES.

There have been seven new forest reserves established during the past year containing a total area of 126,825 acres of which 62,425 acres of unleased Government land have been set apart by proclamation of the Governor.

The Territory now has twelve forest reserves with a total area of 337,147 acres, 117,532 have actually been set aside.

The firm of Alexander & Baldwin has recently turned over to the Government a large private forest in the Koolau, Maui, Forest Reserve owned by one of the plantations controlled by this corporation. This property will be managed in accordance with the terms of the law creating this Board. This action is of considerable importance and indicates the beginning of coöperation on the part of private interests with the Government in the handling of forest land within established forest reserves. It is proposed to establish several other forest reserves as soon as the necessary surveys have been completed.

## FOREST RANGERS.

It is hardly necessary to point out the necessity of a forest ranger service to police and protect the Government forest reserves. The beneficial results to be obtained from the setting aside of these forest lands will be very materially affected if no provisions are made to properly care for the reserves. It is absolutely essential that a ranger service should be established and that the persons appointed to these positions see that boundary fences are maintained, cattle and other animals kept off the lands and that proper precautions are taken to prevent the destruction by fire of the forests.

Very often private interests are allowed to construct flumes and ditches through these reserves and it is important to have some one representing the Government's interests in order to prevent persons employed in constructing and maintaining these waterways from damaging the forests.

Upon the recommendation of the Superintendent of Forestry the Commissioners have included in their recommendations for appropriations to cover the coming biennial period a sum sufficient to establish a ranger service as follows:

Two rangers on Kauai, three on Oahu, one on Molokai, two on Maui and four on Hawaii, making a total of twelve.

While this is a small force to cover the large area already set aside much good work can be accomplished and it is to be hoped that in two years the Territorial revenues will be suf-

ficiently increased to permit of the employment of a larger staff.

## FOREST EXTENSION.

Under the direction of the Superintendent of Forestry advice and assistance have been given to persons and corporations desirous of establishing forest plantations or otherwise interested in forestry.

The Forest Nurseryman has been engaged most of the time on this work. Fourteen planting schemes have been prepared and a large amount of correspondence handled in furnishing information desired.

The distribution of tree seeds has continued, this service offering an opportunity to persons interested in forest work to obtain fresh and pure seeds at nominal prices.

## RUBBER EXPERIMENTS.

It has been impossible to complete the experiments with rubber producing plants undertaken this year but data are being obtained which will be of much value to persons interested in this industry. Tests are being made in order to ascertain the conditions of situation, elevation and exposure which are most favorable to Ceara rubber. Hevea and Castilloa seeds are also being propagated, and will eventually be distributed.

A grove of mature Ceara trees discovered by Mr. Judd during his investigations on Kauai will be systematically tapped and no doubt the reports of the yield of these trees will be of interest to growers of rubber.

## FOREST FIRES.

No destructive forest fires have occurred during the past year and such as were started on forest lands were extinguished before any serious damage was done. Undoubtedly the appointment of forest fire wardens in the various districts and the enactment of a law providing penalties have resulted in more care being taken by persons usually responsible for starting fires and allowing them to get beyond control.

Last spring a special forest ranger for Tantalus Heights was appointed by the Board and he has rendered good service in enforcing the laws and preventing undesirable trespass on the forest lands in this locality.

## REPORTS OF FOREST WORK.

Following the report of the Superintendent of Forestry are those of the Forest Nurseryman and a number of District Foresters containing a large amount of interesting information.

## DIVISION OF ENTOMOLOGY.

This division continues under the charge of Mr. Alexander Craw, with Mr. A. Koebele and Mr. J. Kotinsky as Consulting and Assistant Entomologists respectively. Mr. C. J. Austin, who acted as assistant to the Superintendent in the inspection of importations, resigned in November and has been succeeded by Mr. A. Jordan. Brother Matthias Newell was appointed in August as Inspector for the port of Hilo.

## LOCAL LEGISLATION.

Owing to the fact that there are no Federal laws regulating the importation of pests injurious to vegetable products in Territories, it is quite essential that legislative measures should be enacted in Hawaii giving full powers to the Board to prevent the entering of insects or plant diseases which might prove destructive to agricultural interests here.

Circumstances have arisen during the past year which have made it necessary to place restrictions on the importation of rice from Oriental ports and it is certainly fortunate that the Board has been given powers by the Territorial Statutes to enact such measures.

## INSPECTION OF IMPORTATIONS.

As will be seen by the report of the Superintendent of this Division, it has been necessary to carefully examine a large number of packages arriving by freight as well as through the postal service, and numerous shipments have been de-

stroyed after it had been clearly established that they contained insects or pests injurious to products raised in Hawaii.

The most important matter of this nature requiring the attention of the Superintendent consisted of several importations from Japan of rice from the old crop, infested with bettles and weeviis. Prompt measures were taken to prevent the spread of these insects and after cable communication with the Honorable James Wilson, Secretary of Agriculture, the Collector of Customs was authorized to refuse entry of the rice until the same had been thoroughly fumigated. Successful results were obtained from the use of carbon bisulphide, all of this chemical on hand in the local stores being exhausted before all the shipments were treated. Pending the arrival of an additional supply, hydrocyannic acid gas was tried but proved to be unsatisfactory. The expense of this fumigation was borne entirely by the importers.

Through the courtesy of the Federal officials, it has been possible to install a fumigating apparatus at the Honolulu Post Office where all mail matter containing plants or insects are chemically treated, thus preventing the introduction of any injurious pests through this source.

Fumigatories were installed at the dock and Post Office in Hilo in order that the inspector at this port might have proper facilities for fumigating importations.

Suitable fumigatories have also been placed on three of the wharves in Honolulu which can be charged with light or heavy gases so that the Division is now well equipped for handling of shipments arriving here which require treatment.

## BENEFICIAL INSECTS.

As the Superintendent has been almost constantly engaged in examining importations, the work of breeding and distributing beneficial insects has devolved upon the Assistant Entomologist. Several colonies of useful insects have been received from Mr. A. Koebele, the Consulting Entomologist of the Board, as well as from others mentioned in the Superintendent's report, and colonies have been distributed on the various Islands.

Special attention has been paid to the establishing of enemies to the horn fly, the avocado pear scale and cut worms. It is to be hoped that experiments carried on with the horn fly parasites will result in diminishing this pest which is so troublesome to cattle raisers.

## EQUIPMENT.

Numerous changes in the buildings at the Nursery have facilitated the scientific work of this Division. An addition has been made to the laboratory so as to provide for the installation of modern equipment for microscopic study. The building formerly used for fumigation has been converted into a dark room for photographic purposes and the Board has recently purchased a camera especially adapted to the requirements of this Division.

## GENERAL.

As opportunity has offered, local conditions on the various Islands have been carefully noted with a view to exterminating pests reported as injurious to agricultural products. These investigations are dwelt upon in detail in the report of the Superintendent of this Division.

# DIVISION OF ANIMAL INDUSTRY.

By continuing an arrangement made last year with the Federal Government and the Hawaiian Live Stock Breeders' Association, the Board has been able to retain the services of Dr. V. A. Nörgaard as Superintendent of this Division. He has secured as his assistant, Dr. J. C. Fitzgerald, a veterinary surgeon, who having practiced in the Islands for several years, has had an opportunity of studying diseases of animals most commonly found here.

Dr. H. B. Elliot acts as heretofore as Animal Inspector for Hilo, and as importations are restricted to this port and Honolulu, all animals brought into the Territory can be carefully examined before being admitted.

## INSPECTION.

As will be seen by the report of the Territorial Veterinarian, a large portion of his time has been occupied in inspecting and testing animals arriving at Honolulu.

The appointment of Dr. W. F. Egan, as official examiner for San Francisco and the fact that his certificate as to mallein and tuberculin tests is accepted, has been taken advantage of by local breeders and has resulted in a considerable saving to them as they are not necessarily subject to freight charges on animals brought here and found to be diseased.

The Board has also been fortunate in securing the coöperation of the local representative of the United States Bureau of Animal Industry in San Francisco as he has signified his willingness to inspect all animals shipped from that port and consigned to local importers.

In cases where animals arrive here with suspicious symptoms they are immediately taken to the Quarantine Station at Kalihi where the Territorial Veterinarian has proper facilities for studying their condition. If found to be infected with the suspected disease, they are destroyed, but if healthy, they are turned over to their owners after the expiration of the quarantine period.

The caretaker at the Station sees that the premises are kept in proper sanitary condition and also looks after the feeding and treatment of the animals confined in quarantine.

Territorial property is also reserved at Hilo for similar purposes and is sufficiently isolated to prevent any possibility of contagion.

## GLANDERS.

In order to definitely determine the prevalence of glanders, which is undoubtedly the most serious disease affecting horses and mules found on the Islands, Dr. Nörgaard has made a number of trips to various districts on Hawaii, Maui and Oahu and the reports of his inspections indicate that there are a large number of animals infected with this disease, and it deserves serious consideration as to the best method of stamping it out. Without question the only way to rid the

Territory of glanders, which is found to be so contagious, is by the destruction of infected animals. This is the method adopted in most countries but in Hawaii certain difficulties are met with owing to the large number of Orientals residing here, many of whom are owners of live stock. These persons being of small means are inclined to hide animals showing any indication of glanders and it would therefore seem advisable that some legislative action should be taken whereby owners of diseased stock reporting the same to the Territorial Veterinarian should be reasonably compensated for the destruction of their animals.

Quotations in Dr. Nörgaard's report from an article by Dr. Rutherford of Canada, where this policy has been adopted, show that there is a noticeable tendency on the part of live stock owners to report outbreaks of this disease and to allow their animals to be killed.

## SHEEP.

In the various ranches devoted to sheep raising, it has been found that "Scabies" exists in practically all of the flocks and Dr. Nörgaard has devoted a considerable portion of his time to the treatment of animals infected with this disease. By systematic dipping at frequent intervals in a mixture prepared by the Veterinarian, satisfactory results have been obtained and reports received from some of the ranches indicate that this disease is almost eradicated and now has little effect on the quality or quantity of wool produced.

The screw worm is proving quite injurious to the Island sheep and this pest is now receiving the attention of Dr. Nörgaard.

## HEART WORM.

It is interesting to note that the Territorial Veterinarian has been endeavoring to find some remedy for this disease which is so destructive to hunting dogs, especially to those imported from the United States and foreign countries.

## CONSULTATION.

In establishing the Bureau of Animal Industry, it was the desire of the Commissioners that the services of the Territorial Veterinarian should at all times be available to owners desiring advice in regard to diseases affecting their stock and Dr. Nörgaard and his assistant have given careful consideration to all inquiries referred to them.

## LABORATORY.

This Division has been without sufficient funds to properly equip a laboratory for the scientific investigation of animal diseases found in the Islands.

In the recommendations to cover the biennial period commencing July 1st, 1907, the Board has included a special amount to cover the cost of extensions to the building at the Government Nursery and necessary instruments to efficiently carry on this important branch of the work.

## GENERAL.

The live stock industry has been greatly benefitted by the creation of this Division and it is to be hoped that ample appropriations will be made for the coming two years so that its scope may be enlarged.

# DIVISION OF AGRICULTURE.

The Legislature at the last session appropriated the sum of $5,472.00 for "Assistance to the Federal Experiment Station," and as will be seen by the report of Mr. Jared G. Smith, Director in charge of the Station here, most of this money has been expended on experiments in growing various varieties of tobacco.

It seems to be well established that tobacco of good quality can be raised on the Island of Hawaii, especially in the Hamakua district, and the results should be encouraging to those desiring to engage in this industry for commercial purposes.

Probably a larger crop of high grade leaf could be obtained by engaging the services of a tobacco curing expert.

Respectfully submitted,

L. A. THURSTON,
C. S. HOLLOWAY,
W. M. GIFFARD,
A. W. CARTER,
J. F. BROWN,
G. P. WILDER,
Commissioners of Agriculture and Forestry.

**APPROPRIATIONS FOR BOARD OF AGRICULTURE AND FORESTRY, PASSED BY THE LEGISLATURE AT THE EXTRA SESSION OF 1905, FOR THE BIENNIAL PERIOD, JULY 1, 1905, TO JUNE 30, 1907.**

**Statement to December 31, 1906.**

SALARIES AND PAY ROLLS.

| | Appropriation. | Balance Dec. 31, 1905. | Drawn. | Balance Dec. 31, 1906. |
|---|---|---|---|---|
| Salary of Superintendent of Forestry | $ 6,000.00 | $ 4,500.00 | $ 2,703.23 | $ 1,796.77 |
| Pay of Assistants, Laborers and Rangers, Division of Forestry | 4,000.00 | 3,010.00 | 1,930.00 | 1,080.00 |
| Salary of Superintendent of Entomology | 6,000.00 | 4,500.00 | 3,000.00 | 1,500.00 |
| Pay of Assistants, Inspectors and Employees, Division of Entomology | 5,000.00 | 3,760.00 | 2,405.48 | 1,354.52 |
| Salary of Clerk and Stenographer | 1,800.00 | 1,350.00 | 900.00 | 450.00 |
| Salary of Territorial Veterinarian | 1,400.00 | 1,050.00 | 700.00 | 350.00 |
| Pay of Assistants, Inspectors, Employees and Laborers of Division of Animal Industry | 1,000.00 | 935.00 | 525.00 | 410.00 |
| | $25,200.00 | $19,105.00 | $12,163.71 | $ 6,941.29 |

CURRENT EXPENSES.

| | | | | |
|---|---|---|---|---|
| Incidentals and General Expenses and Experimenting in Growing Rubber Trees on Government Forest Lands | $29,848.00 | $24,606.98 | $16,896.82 | $ 7,710.16 |
| Assistance to Federal Experiment Station | 5,472.00 | 3,740.95 | 3,203.77 | 537.18 |
| Incidentals and General Expenses, Bureau of Animal Industry | 250.00 | 102.25 | 101.50 | .75 |
| | $35,570.00 | $28,450.18 | $20,202.09 | $ 8,248.09 |

# DIVISION OF FORESTRY.

## Report of the Superintendent of Forestry.

Honolulu, Dec. 31, 1906.

Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:—I have the honor to submit the following report covering the work of the Division of Forestry during the calendar year 1906; and to transmit in addition certain reports from my assistant, the Forest Nurseryman, and from a majority of the District Foresters, dealing in detail with various aspects of forestry in the Territory.

The past year has been one of construction in the forest work of Hawaii. While marked by no spectacular accomplishments—forest work seldom is—it has seen much done toward strengthening the foundations upon which forestry in the islands rests; work which cannot but result in benefit to the Territory in the years that are to come.

The general program of forest work adopted when the Division of Forestry was organized three years ago has been followed during 1906. The creation of forest reserves has continued to hold first place in the activities of the Division and has claimed the major part of my own time and attention, as it must in future until the projected system of forest reserves is actually established.

Next in importance has come the work of the Section of Forest Extension. The notable feature here is the increasing number of requests that have been received for advice and assistance from persons or corporations desiring to establish forest plantations. It has been clearly demonstrated that the offer of cooperative assistance published in December, 1905, meets a real demand; one that will become more and more

pressing as the natural supply of wood diminishes. This branch of the Division's work has been under the direct charge of Mr. David Haughs, Forest Nurseryman, who from his intimate acquaintance with island conditions is well fitted to handle it. The policy of helping the individual to help himself will, it is believed, result in much permanent good to the Territory. Certainly the expenditure so made goes much further than would a very much larger sum devoted to actual tree planting by the Territory itself. This work will therefore be continued during the coming year.

Other branches of forest work have received as much attention as the very limited staff could give them. The results achieved are set forth in the following pages under the several main headings under which the work of the Division of Forestry may naturally be divided.

## APPROPRIATION.

The appropriation for salaries on the statutory roll of the Division of Forestry for the present fiscal period (July 1, 1905 to June 30, 1907) was $10,000.00, or $5,000.00 per annum. Of the total lump sum appropriated for the Current Expenses of the Board ($29,848.00), the amount allotted to the Division of Forestry was $5,450.00 per annum. During the past year, owing to a re-allotment made necessary by the needs of the Division of Animal Industry, the Forestry fund was somewhat curtailed, thereby reducing the amount available for forestry items. The necessity for this cut is to be regretted but that it was unavoidable and essential to the work of the Board as a whole is not questioned.

## STAFF.

The regular staff of the Division of Forestry during 1906 has consisted of the Superintendent of Forestry and the Forest Nurseryman.

For a period of two months during the summer Mr. Charles S. Judd was appointed temporarily, as Special Forest Agent, to carry on certain investigations on Kauai. These are discussed on another page of this report.

One forest ranger, Mr. David Kapihe was appointed in March for patrol duty in the Tantalus Heights District, to see that the regulations of the Board in regard to forest fire and trespass were carried out. He continues to serve.

Several additional District Foresters and District Fire Wardens have been appointed during the year and some other changes have been made in the personnel of these corps. Revised lists are given elsewhere in this report.

As in former years, the stenographic and clerical work of the Division of Forestry has been performed by the general clerk and stenographer of the Board, Miss Melika Peterson.

Mention may be made here of my absence from the Territory from April 7 to July 13. Two months of this period was a leave of absence; the remainder was a furlough without pay. In the course of my vacation I visited the eastern states, spending some time in Washington, D. C., and in Boston. During my absence Mr. Haughs was Acting Superintendent of Forestry and Acting Chief Fire Warden.

## FOREST RESERVES.

The objects for which the Hawaiian forest reserves are made have been so often set forth that it seems almost unnecessary to repeat the statement here. But lest this report fall into the hands of persons not familiar with the local conditions it may be said that the native Hawaiian forests are chiefly of value as conservators of water, and that the forest reserves are created on the important watersheds of the Terriory that the forest within their boundaries may be permanently maintained as a protective cover. On the drainage from the area that the forest reserves do or will include depends the supply of the various irrigation and power-development systems that have been or may be built on each of the large islands. In Hawaii, as on the mainland, forestry and irrigation are closely related; only by the perpetuation of the forest cover can the streams be maintained and their flow kept relatively constant.

The Hawaiian forest reserves are created by the Governor of the Territory, who acting on the recommendations of the Board of Agriculture and Forestry, declares by proclamation that with-

in certain specified boundaries the land should be permanently maintained under a forest cover. This declaration constitutes the area a forest reserve. The Governor then sets apart such unleased government lands as may be within the reserve boundaries, and from time to time, as the leases on other government lands in the reserve expire, adds them as well to the area actually set apart. In most of the reserves there is also privately owned land, but that this may be treated as an organic part of the reserve, the law provides that the management and control may be turned over to the Board of Agriculture and Forestry. Such action has already been taken in one reserve. The law creating the present Board of Commissioners of Agriculture and Forestry, and providing for the establishment of forest reserves, is Chapter 28 of the Revised Laws of Hawaii.

## RESERVES ESTABLISHED.

During the year seven new forest reserves have been created. They have an aggregate area of 126,825 acres and are distributed throughout the Territory as follows: Kauai, one; Oahu, three; Maui, one; Hawaii, two. Of the total area, 62,425 acres have been actually set apart.

The total number of forest reserves is now twelve. These have a combined total area of 337,147 acres within the reserve boundaries. Of this 117,532 acres of unleased government land have been actually set apart.

The following table gives the essential facts about the twelve established forest reserves, arranged in the order of the creation of the reserves. The several slight differences in area between this and similar tables heretofore published are due to corrected computations of area, recently made by the Survey Office.

TABLE I.

FOREST RESERVES—TERRITORY OF HAWAII.

ARRANGED IN CHRONOLOGICAL ORDER.

| No. | Name | District | Island | Total Area Recommended to be Reserved | Area Government Land Actually Reserved | Date of Proclamation | Proclamations Signed by |
|---|---|---|---|---|---|---|---|
| | | | | Acres | Acres | | |
| 1 | Kaipapau .. | Koolauloa .... | Oahu... | 913 | 913 | Nov. 10, 1904 | G. R. Carter |
| 2 | Hamakua Pali | Hamakua. .... | Hawaii.. | 18,940 | 16,133 | Dec. 23, 1904 | " " |
| | Total for 1904..... | | | 19,853 | 17,046 | | |
| 3 | Hilo..... | Hilo..... | Hawaii.. | 110,000 | 12,771 | July 24, 1905 | A. L. C. Atkinson |
| 4 | Koolau, Maui | Koolau, Hamakua-loa. .... | Maui.... | 42,969 | 14,300 | Aug. 24, 1905 | " " " |
| 5 | Halelea..... | Halelea ..... | Kauai. . | 37,500 | 10,990 | Aug. 24, 1905 | " " " |
| | Total for 1905..... | | | 190,469 | 38,061 | | |
| 6 | Kealia..... | Puna..... | Kauai. . | 9,935 | 7,385 | Mar. 9, 1906 | " " " |
| 7 | Ewa.. ..... | Ewa, Waianae and Waialua | Oahu... | 28,550 | 4,768 | Mar. 9, 1906 | " " " |

TABLE I—Continued.

| No. | Name | District | Island | Total Area Recommended to be Reserved | Area Government Land Actually Reserved | Date of Proclamation | Proclamations Signed by |
|---|---|---|---|---|---|---|---|
| | | | | Acres | Acres | | |
| 8 | Honuaula .. | Kona ..... | Hawaii . | 665 | 665 | Apr. 4, 1906 | A. L. C. Atkinson |
| 9 | Kau ..... | Kau ..... | " . | 65,850 | 35,960 | Aug. 2, 1906 | G. R. Carter |
| 10 | Waianae-kai. | Waianae ..... | Oahu .. | 3,257 | 3,150 | Sept. 7, 1906 | " " |
| 11 | Lualualei ... | " ..... | " .. | 3,743 | 3,743 | Nov. 30, 1906 | " " |
| 12 | Hana ..... | Hana ..... .. | Maui .. | 14,825 | 6,754 | Nov. 30, 1906 | " " |
| | Total for 1906 ..... | | | 126,825 | 62,425 | | |
| | Grand total ..... | | | 337,147 | 117,532 | | |

Table II shows the same data for the existing reserves, arranged by islands and counties.

TABLE II.

FOREST RESERVES—TERRITORY OF HAWAII.

ARRANGED BY COUNTIES.

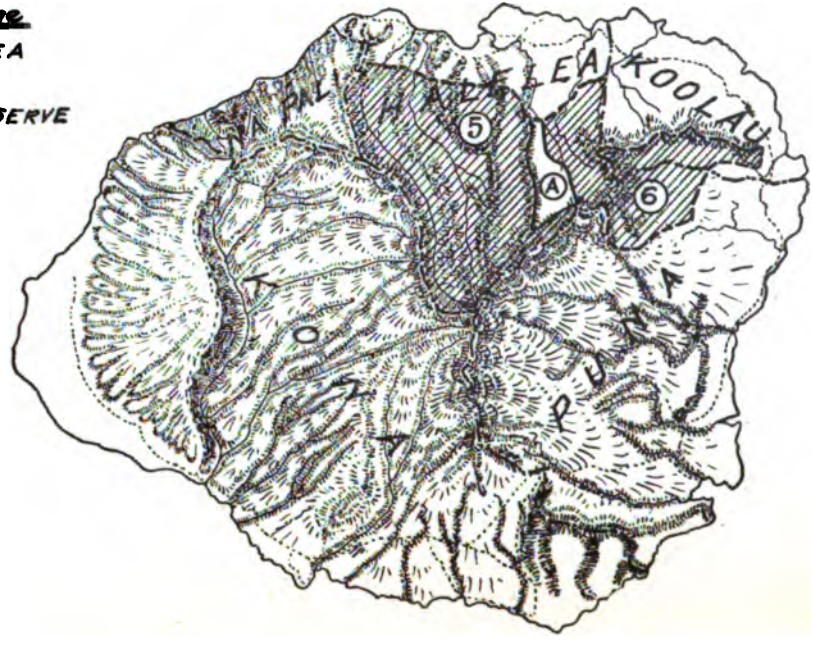
| No. | Name | District | Island | Total Area Recommended to be Reserved | Area Government Land Actually Reserved | Date of Proclamation | Proclamations Signed by |
|---|---|---|---|---|---|---|---|
| | | | COUNTY OF KAUAI. | | | | |
| | | | | Acres | Acres | | |
| 5 | Halelea | Halelea | Kauai | 37,500 | 10,990 | Aug. 24, 1905 | A. L. C. Atkinson |
| 6 | Kealia | Puna | " | 9,935 | 7,385 | Mar. 9, 1906 | " " " |
| | | | Total, | 47,435 | 18,375 | | |
| | | | COUNTY OF OAHU. | | | | |
| 1 | Kaipapau | Koolauloa | Oahu | 913 | 913 | Nov. 10, 1904 | G. R. Carter |
| 7 | Ewa | Ewa, Waianae and Waialua. | " | 28,550 | 4,768 | Mar. 9, 1906 | A. L. C. Atkinson |
| 10 | Waianae-kai | Waianae | " | 3,257 | 3,150 | Sept. 7, 1906 | G. R. Carter |
| 11 | Lualualei | " | " | 3,743 | 3,743 | Nov. 30, 1906 | " " |
| | | | Total, | 36,463 | 12,574 | | |

TABLE II—Continued.

| No. | Name | District | Island | Total Area Recommended to be Reserved | Area Government Land Actually Reserved | Date of Proclamation | Proclamations Signed by |
|---|---|---|---|---|---|---|---|
| | | | COUNTY OF MAUI. | | | | |
| | | | | Acres | Acres | | |
| 4 | Koolau, Maui | Koolau, Hamakua-loa | Maui ... | 42,969 | 14,300 | Aug. 24, 1905 | A. L. C. Atkinson |
| 12 | Hana ..... | Hana ..... | " ... | 14,825 | 6,754 | Nov. 30, 1906 | G. R. Carter |
| | | | Total, | 57,794 | 21,054 | | |
| | | | COUNTY OF HAWAII. | | | | |
| 2 | Hamakua Pali | Hamakua ..... | Hawaii .. | 18,940 | 16,133 | Dec. 23, 1904 | G. R. Carter |
| 3 | Hilo ..... | Hilo ..... | " .. | 110,000 | 12,771 | July 24, 1905 | A. L. C. Atkinson |
| 8 | Honuaula .... | Kona ..... | " .. | 665 | 665 | Apr. 4, 1906 | " " " |
| 9 | Kau ..... | Kau ..... | " .. | 65,850 | 35,960 | Aug. 2, 1906 | G. R. Carter |
| | | | Total, | 195,455 | 65,529 | | |
| | | Grand Total, ..... | | 337,147 | 117,532 | | |

# Forest Reserves
# Island of Kauai
## Territory of Hawaii

| No. | Name |
|---|---|
| 5 | Halelea |
| 6 | Kealia |
| A | Agr. Reserve |




Scale 1 inch = 4 miles.

Prepared by Gov't Survey Department 1906

# FOREST RESERVES
# ISLAND OF KAUAI
## TERRITORY OF HAWAII

Key
A Haupu
B Kealia
C Kapaa

**ERRATUM.**

For "Kealea" read "Kealia," lines 2 and 5, page 23.

The seven reserves made in 1906 may be thus briefly described:

*Kealea Forest Reserve, Kauai.*

This reserve includes the mauka portion of the three large government lands of Anahola, Kamalomalo and Kapaa, and the private land of Kealea, at the north end of the PunaDistrict, Island of Kauai. The total area is 9,935 acres. That of the government land actually set apart is 7,385 acres, or 74 per cent. Its value as a watershed justifies the creation of this reserve.

*Ewa Forest Reserve, Oahu.*

The section covered by this reserve is one of the most important watersheds in the Territory, in that it supplies the major part of the water for the three great sugar plantations, Ewa, Oahu and Honolulu, whose combined output made in 1906 over one-sixth of the total sugar crop of the Territory. The total area of this reserve is 28,550 acres. Much of it is private land, but of the 5,151 acres belonging to the Territory 4,768 have been set apart. This is 1.7 per cent of the whole reserve and 93 per cent of the government land.

*Honuaula Forest Reserve, Hawaii.*

The Honuaula Forest Reserve is a tract of 665 acres on the western slope of Mt. Hualalai in the District of Kona on Hawaii. It is part of a government land now under lease for grazing but by an arrangement effected through the Land Office this area was surrendered and set apart as a reserve. It contains some of the best Koa (*Acacia Koa*) forest on any government land on Hawaii.

*Kau Forest Reserve, Hawaii.*

The Kau Forest Reserve is another very important reserve because from it comes the water that serves the two large sugar plantations in Kau to flume their cane and irrigate their lower lands. The reserve lies on the lower slopes of Mauna Loa. It is the second in size of the reserves so far declared. The total area is 65,850 acres. Of this 55 per cent., or 35,960 acres of government land have been actually set apart.

*Waianae-kai and Lualualei, Oahu.*

These two reserves are situated on the western slope of the Waianae mountains on Oahu and in reality form one tract. They include both the scanty forest on the upper slopes and the barren ridges lower down that should be brought back under a forest cover. With lands on the leeward side of the islands it is essential that all the water possible be made available for use. A forest on the slopes will help to secure this result; hence the reserve. The area of Lualualei is 3,743 acres, all reserved; that of Waianae-kai 3,257 acres, of which all but 107 acres (3 per cent.) is government land, actually set apart.

*Hana Forest Reserve, Maui.*

The Hana Reserve includes the entire mauka portion of the Hana District. It covers an area of 14,825 acres, the greater part of which is government land. There are actually set apart 6,754 acres, or 46 per cent. This reserve is also important as a protective forest, especially in connection with the Koolau Forest Reserve, which it adjoins.

DETAILED REPORTS.

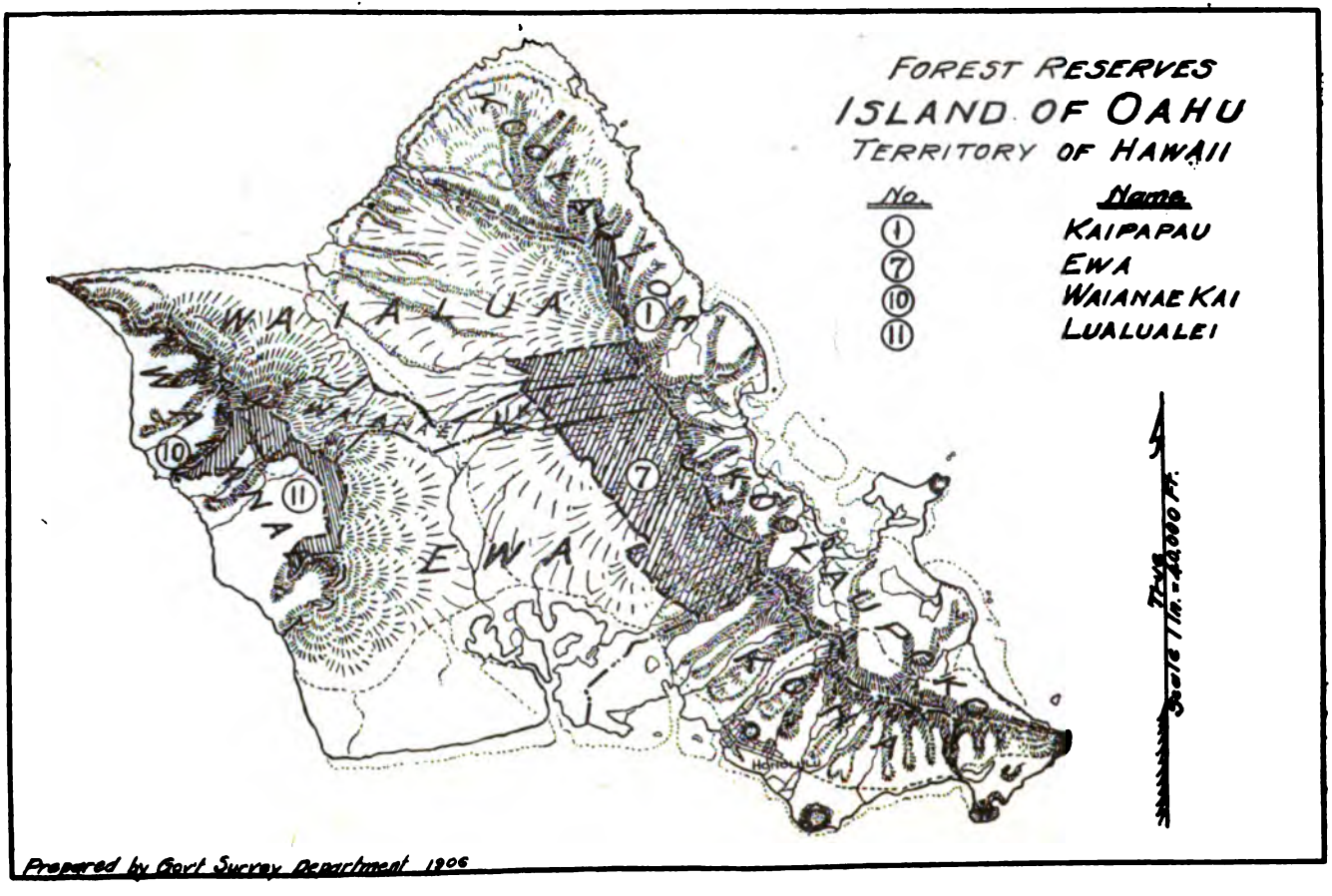
Following the established usage of the Board the reports, resolutions, descriptions of boundaries and proclamations dealing with the several reserves have been published in the Hawaiian Forester and Agriculturist as each reserve has been made. The original reports are filed in the office of the Board of Agriculture and Forestry, with official copies of the proclamations and descriptions.

FOREST MAPS.

The twelve established forest reserves are shown on the accompanying maps of the four main islands of the Hawaiian group. The maps were prepared under my direction by the Government Survey Office and are based on the large scale official maps of the several islands.

PRIVATE CO-OPERATION—WAIANAE-KAI RESERVE.

A feature of no small interest in the creation of the Waianae-kai Forest Reserve was the action taken by the Waianae


FOREST RESERVES
ISLAND OF OAHU
TERRITORY OF HAWAII
No.
Name
1 KAIPAPAU
7 EWA
10 WAIANAE KAI
11 LUALUALEI
WAIALUA
KOOLAU
EWA
KOOLAU
Honolulu
SCALE 1 in. = 4 MILES
Prepared by Govt Survey Department 1906

(Plantation) Company to facilitate the actual setting apart of the area. Under an agreement with the Land Commissioner the Waianae Company signed a partial surrender of their lease on the land covered by the reserve, whereby the term of the lease was shortened by one year and so brought within the two-year-limit-of-expiration clause of the forest law.

The Waianae Company has further shown its interest in this reserve by undertaking to reforest, at its own expense, considerable areas on the lower slopes of the mountain within the reserve boundaries. A planting plan for this work has been drawn up by Mr. Haughs and preparations for planting have already begun. For its active support of the forest reserve policy of the Territory the Waianae Company deserves special commendation. It is by such intelligent coöperation that the cause of forestry in Hawaii is strengthened and advanced.

## MAUI FOREST LAND SURRENDER.

One of the most notable events of the present year, in view of its far reaching effect, was the turning over to the Government by the plantations in Ceneral Maui controlled by Messrs. Alexander and Baldwin, of the management of certain privately owned lands within the Koolau Forest Reserve. Owing to the fact that several corporations were involved, considerable legal formality attended this transfer, which it took the greater part of the year to bring to completion. The final papers were signed on Nov. 12th, 1906.

In brief the arrangement is that the Paia Plantation, the Haiku Sugar Company, and the Hawaiian Commercial and Sugar Company turn over to the Government for a term of 17 years from Feb. 26th, 1906, the care, custody and control of the privately owned lands of Halehaku, Haiku, Opana and Kaupakulua within the boundaries of the Koolau Forest Reserve, excepting and reserving however (1) all water rights, (2) rights of way for roads, ditches, tunnels, flumes and pipe lines, (3) the right to plant trees, (4) the right to cut fence posts for local use, and (5) the right to make economic use of the forest, subject to reasonable rules and regulations of the Board of Agriculture and Forestry and in a way not inconsistent with the purposes of the reserve. Under each of these clauses are included

the rights of ingress and egress. The plantations agree, in addition, to keep the makai boundary of the reserve fenced during the term of the agreement.

The surrender is made contingent on the following points: (1) that the lands surrendered be used by the Government solely for forest purposes, (2) that all government lands within the reserve be set apart now or as soon as may be as parts of the reserve, (the only additional tract that, under the law, can be reserved is about to be set apart), (3) that if all or any portion of the two tracts of government land covered by leases Nos. 538 and 539 revert to the Government during the seventeen years, such lands shall be added to the reserve, and (4) that all government lands within the reserve shall be used only for forest purposes during the period of the surrender, except that the Government may exercise rights similar to those reserved to the plantations. Failure on the part of the Government to comply with these conditions nullifies and terminates the whole agreement. The term of seventeen years expires on the same day as do the leases (Nos. 538 and 539) of the government lands adjoining the private lands surrendered.

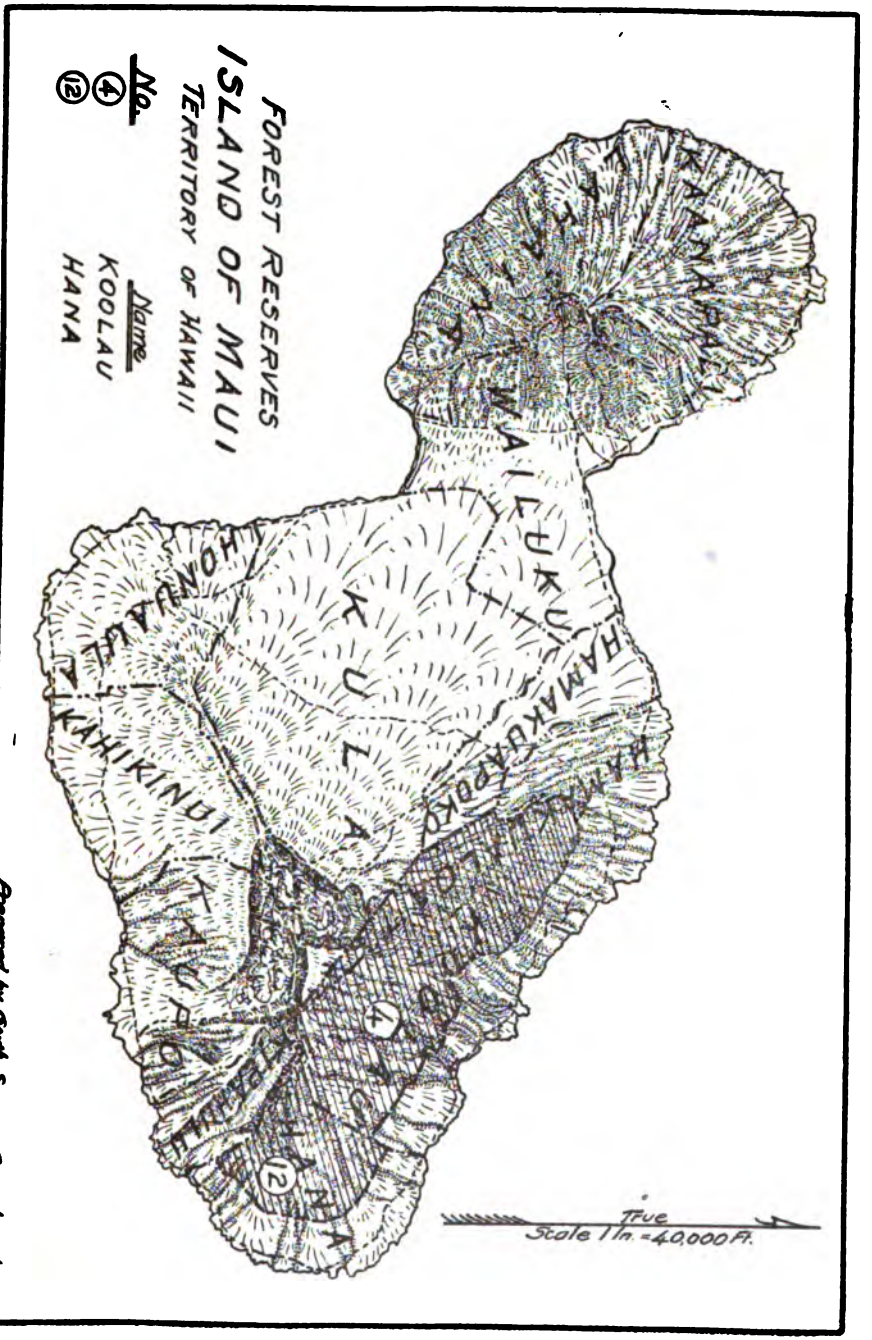
The full text of the surrender, which is a lengthy legal document, was published in the Hawaiian Forester and Agriculturist for December, 1906.

The action taken in this instance will serve as a precedent in future cases, of which it is hoped there will be many, for only by the putting into operation of a systematic and organic plan for the management of any given reserve as a whole, can the best results be attained.

The foregoing statement brings the question to the point on which the whole matter turns, for unless the Government will make it evident that it can exercise an efficient and satisfactory control over the forest reserves, private interests owning land within the reserve boundaries will be slow to agree to turn the management of their lands over to the Board.

## FOREST RANGERS.

The establishment of a forest ranger service for the proper administration of the reserves that already exist, or that will




Engraved by Govt. Survey Department 1906

soon be created is therefore the most pressing need in the forest work of Hawaii today. The necessity for such action is obvious and I cannot too strongly urge that the attention of the Legislature be called to this matter in the most forcible way. Important steps have been taken in getting the reserves established by proclamation, and the boundaries defined more or less thoroughly on the ground, but until an administrative force is actually in commission the reserve system will not have been truly started.

To show how this general question is regarded by the men who as a body have given most careful attention to the forest question in Hawaii, I insert the following resolution unanimously adopted by the Hawaiian Sugar Planters' Association, at the annual meeting held in Honolulu during November, 1906.

*Resolution.*

(Adopted by the Hawaiian Sugar Planters' Association, at a meeting held in Honolulu, on Nov. 21, 1906).

"Resolved, That the Hawaiian Sugar Planters' Association hereby expresses its hearty approval of the policy of setting apart forest reserves, inaugurated and now being prosecuted by the Territorial authorities;

"That it is the opinion of this Association that said policy should be supplemented:

"(1) By providing rangers to guard and protect such reserves from fire, trespassers and depredation;

"(2) By the initiation of systematic reforesting of such portions of said reserves as are not now covered with trees;

"That we hereby petition the Legislature of the Territory to make adequate appropriations for the purposes aforesaid."

## FOREST RESERVE PROJECTS.

As I pointed out in my last annual report, the table of forest reserves actually established at any one time is not a true index by which to measure the work accomplished to that date. As this report goes to press there are several projects that need only a little more work to bring them to a head, and so into the list of reserves established.

*Na Pali-Kona, Kauai.*

The proposed Na Pali-Kona reserve on Kauai is one of these. This proposed reserve embraces the greater part of the mauka portion of the Na Pali and the western end of the Kona Districts on Kauai. It covers an area of 60,040 acres. A large proportion of the reserve is government land under lease for some years to come but 3,980 acres in Na Pali can be now actually set part.

All the section covered by the proposed reserve is under forest cover;most of it is heavily wooded. Both the leased government and the fee simple lands have for some time been maintained as private forest reserves by the lessees or owners, who have driven out the wild cattle or exterminated them.

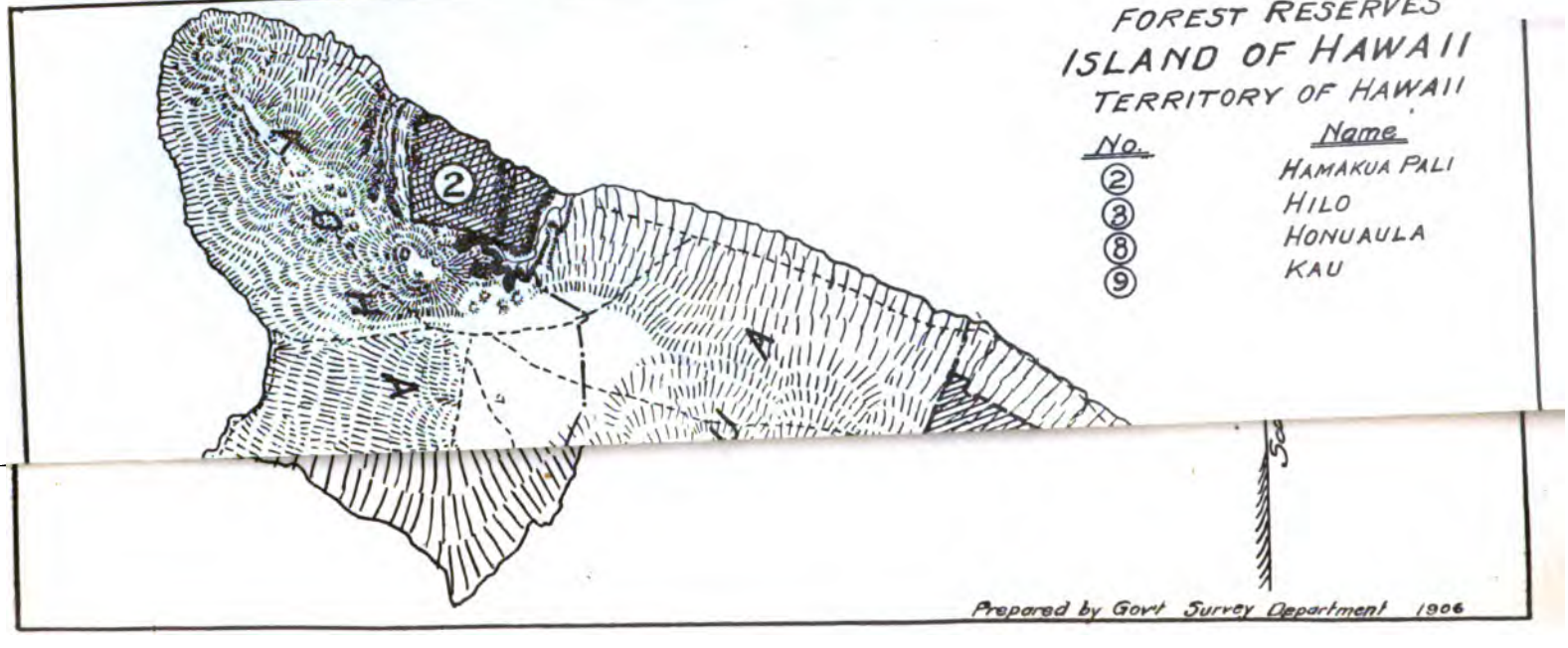
The object of the proposed Na Pali-Kona Reserve is to protect the watersheds of the important streams on the leeward side of Kauai, which from their volume and fall are of very great value in the development of that island. Somewhat used at present for irrigation these streams are capable of being harnessed and made to produce immense quantities of power, as well as being made use of more extensively for irrigation. The project only awaits the completion of my report to be brought before the Board for action.

*Other Forest Reserve Projects on Kauai.*

From field work done during the past year I am now prepared to report upon a forest line through the Districts of Kona, Puna and Koolau, connecting the existing reserves, above which in my judgment the forest cover ought to be permanently maintained. Surveys are now in progress to define several sections of this boundary. As soon as the descriptions are in hand, reports with recommendations will be submitted to the Board.

*Proposed Forest Reserves on Oahu.*

Several small reserves are projected on the Waianae Mountains, which when completed will result in the reservation of nearly the whole of the upper part of this range. The proposed Makua-Keaau Reserve only awaits a survey to define its exact


FOREST RESERVES
ISLAND OF HAWAII
TERRITORY OF HAWAII
No.
Name
2 HAMAKUA PALI
3 HILO
8 HONUAULA
9 KAU
2
Prepared by Govt Survey Department 1906

boundaries. The mauka part of Mokuleia is in much the same case, while a survey is now in progress to define the forest boundary on the large private land of Honouliuli.

On the Koolau Mountains arrangements are well under way to extend the existing Ewa Reserve into the Waialua District, and preliminary steps have been taken in regard to reserving the section at the northwest end of the Koolau range.

*Maui and Molokai.*

Through no lack of interest but because of the press of other work, seemingly of more immediate importance, the status of the forest lands on the West Maui Mountain and on the Island of Molokai has not changed since my last annual report. During 1907 the forest problems in these localities will be studied and the reserve projects brought to the point of action. There is also forest work to be done on the slopes of Mt. Haleakala. This, too, will be taken up during the coming year.

*Hawaii.*

The Kohala Mountain Reserve project is now the most important reserve work to be done on Hawaii. Progress has been made on this proposed reserve during the year but it still remains for a survey to be made before definite action can be taken on it. The District of Kona has forest problems that claim attention. These it is expected can be taken up early in 1907.

LAND CLASSIFICATION IN RESERVES.

As has already been pointed out the Hawaiian forest reserves contain three classes of land, (1) government land, not leased, (2) government land, leased, and (3) land in private, fee simple ownership. To further elucidate this matter and to make available for ready reference the valuable data contained therein, I append tables showing the several classes of land in each of the established forest reserves. These tables were prepared under the direction of Mr. W. E. Wall, Government Surveyor, by Mr. R. D. King. They are reproduced with Mr. Wall's permission.

## TABLE III.

AREAS OF LANDS IN FOREST RESERVES.

(Corrected to December 31, 1906—Prepared by the Survey Department.)

ISLAND OF KAUAI.

| Reserve | Lease | Government Lands | | | | Private Lands | | Total |
|---|---|---|---|---|---|---|---|---|
| Name | Number | Leased | | Not Leased | | | | |
| | | Acres | Acres | Acres | Acres | Acres | Acres | Acres |
| Halelea Forest Reserve— | | | | | | | | |
| Wainiha (private) | | | | | | 11,050.00 | | |
| Lumahai " | | | | | | 8,975.00 | | |
| Waipa " | | | | | | 800.00 | | |
| Waioli | | | | *2,650.00 | | | | |
| Hanalei | | | | *8,340.00 | | | | |
| Kalihiwai (private) | | | | | | 5,685.00 | | |
| | | | | | *10,990.00 | | 26,510.00 | 37,500.00 |
| Kealia Forest Reserve— | | | | | | | | |
| Anahola | 44 | *4,018.00 | | | | | | |
| Kamalomalo | 514 | *1,033.00 | | | | | | |

* Government lands set apart by proclamation as forest reserves.

Leased lands marked * are set apart under the two-year limit of expiration of lease clause.

W. R.—Water rights only are leased.

For additional information regarding leased lands see "List of Public Lands," issued by the Land Department.

TABLE III—Continued—ISLAND OF KAUAI.

| Reserve | Lease | Government Lands | | | | Private Lands | | Total |
|---|---|---|---|---|---|---|---|---|
| Name | Number | Leased | | Not Leased | | | | |
| | | Acres | Acres | Acres | Acres | Acres | Acres | Acres |
| Kealia Forest Res.—Con. | | | | | | | | |
| Kealia (private) | | | | | | 2,550.00 | | |
| Kapaa | 44 | *2,334.00 | | | | | | |
| | | | *7,385.00 | | | | 2,550.00 | 9,935.00 |
| Total, Kauai | | | *7,385.00 | | *10,990.00 | | 29,060.00 | 47,435.00 |

TABLE III—Continued—ISLAND OF OAHU.

| Reserve Name | Lease Number | Government Lands Leased | Government Lands Not Leased | | | Private Lands | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Acres | Acres | Acres | Acres | Acres | Acres | Acres |
| Kaipapau Forest Reserve— | | | | | | | | |
| Kaipapau | | | | *913.00 | | | | |
| | | | | | *913.00 | | | 913.00 |
| Ewa Forest Reserve— | | | | | | | | |
| Wahiawa | 530 (W. R.) | | | *3,978.00 | | | | |
| Waianae uka (U. S. Army Reservation) | 68 | | | | | 4,247.00 | | |
| Waipio (private) | | | | | | 5,080.00 | | |
| Waiawa " | | | | | | 4,040.00 | | |
| Manana " | | | | | | 1,090.00 | | |
| Waimano | | | | *790.00 | | | | |
| Waiau (private) | | | | | | 1,320.00 | | |
| Waimalu " | | | | | | 2,238.00 | | |
| Kalauao " | | | | | | 1,538.00 | | |
| Aiea | 66A | 383.00 | | | | | | |
| Halawa (private) | | | | | | 3,846.00 | | |
| | | | 383.00 | | *4,768.00 | | 23,399.00 | 28,550.00 |

TABLE III—Continued—ISLAND OF OAHU.

| Reserve Name | Lease Number | Government Lands | | | | Private Lands | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Leased | | Not Leased | | | | |
| | | Acres | Acres | Acres | Acres | Acres | Acres | Acres |
| Waianae-kai Forest Res.— | | | | | | | | |
| Waianae kai | 60 | *3,150.00 | | | | | | |
| Waianae kai (grants) | | | | | | 106.80 | | |
| | | | *3,150.00 | | | | 106.80 | 3,256.80 |
| Lualualei Forest Reserve— | | | | | | | | |
| Lualualei | | | | *3,743.00 | | | | |
| | | | | | *3,743.00 | | | 3,743.00 |
| Total, Oahu | | | 3,533.00 | | *9,424.00 | | 23,505.80 | 36,462.80 |

TABLE III—Continued—ISLAND OF MAUI.

| Reserve Name | Lease Number | Government Lands | | | | Private Lands | Total |
|---|---|---|---|---|---|---|---|
| | | Leased | | Not Leased | | | |
| | | Acres | Acres | Acres | Acres | Acres | Acres |
| Koolau-Maui Forest Res.— | | | | | | | |
| Opana (private) | | | | | | 10,899.00 | |
| Peahi " | | | | | | | |
| Haiku " | | | | | | | |
| Halehaku " | | | | | | 1,840.00 | |
| Honopou-W. Makaiwa | 475 (W. R.) | | | *4,800.00 | | | |
| E. Makaiwa-Keopuka | 267B (W.R.) | | | *1,400.00 | | | |
| Honomanu | 52 | 2,000.00 | | | | | |
| Keanae, Mauka | 539 | 8,750.00 | | | | | |
| Wailua, 1 and 2 Mauka | 539 | 1,280.00 | | | | | |
| Wailua-Ulaino Forest | 538 | 3,000.00 | | | | | |
| " " " | 492 | 900.00 | | *8,100.00 | Lease 520B W. R | | |
| | | | 15,930.00 | | *14,300.00 | 12,739.00 | 42,969.00 |
| Hana Forest Reserve— | | | | | | | |
| Hana Forest | 492 | 6,330.00 | | *5,242.00 | | | |
| W. Honomaele (private) | | | | | | 187.00 | |
| E. Honomaele | 474 | 15.00 | | *115.00 | | | |
| Kawela-Kaeleku | 474 | 65.00 | | | | | |
| Wakiu | 518 | 3.00 | | *15.00 | | | |
| Aleamai (private) | | | | | | 357.00 | |

TABLE III—Continued—ISLAND OF MAUI.

| Reserve Name | Lease Number | Government Lands | | | | Private Lands | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Leased | | Not Leased | | | | |
| | | Acres | Acres | Acres | Acres | Acres | Acres | Acres |
| Hana Forest Reserve—Con. | | | | | | | | |
| Haneoo (private) | | | | | | 84.00 | | |
| Kakio | | | | *700.00 | | | | |
| Waiohonu | | | | *33.00 | | | | |
| Puukai-Papahawahawa | | | | *68.00 | | | | |
| Muolea (private) | | | | | | 430.00 | | |
| Koali-Puuhaoa | 479B | 600.00 | | | | | | |
| Wailua | 583 (W. R.) | | | *270.00 | | | | |
| Puaaluu | | | | *311.00 | | | | |
| | | | 7,013.00 | | *6,754.00 | | 1,058.00 | 14,825.00 |
| Total, Maui | | | 22,943.00 | | *21,054.00 | | 13,797.00 | 57,794.00 |

TABLE III—Continued—ISLAND OF HAWAII.

| RESERVE<br>Name of Land | LEASE<br>Number | GOVERNMENT LANDS | | | | PRIVATE LANDS | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | Leased | | Not Leased | | | | |
| | | Acres | Acres | Acres | Acres | Acres | Acres | Acres |
| Hamakua Pali Forest Res'r'e<br>Laupahoehoe<br>Nakooka<br>Apua<br>Waikapu<br>Honopue | 560 (W.R.) | | | *10,533.20 | | | | |
| Laupahoehoe (private) | | | | | | 2,350.00 | | |
| Waimanu | 524 | 200.00 | | | | | | |
| Waimanu:—kuleanas and homesteads | | | | | | 256.80 | | |
| Waimanu and Muliwai, including the private ili of Kekealani, (unsurv'yed) | | | | *5,600.00 | | | | |
| | | | 200.00 | | *16,133.20 | | 2,606.80 | 18,940.00 |
| Hilo Forest Reserve—<br>Humuula | 75 | 3,901.00 | | | | | | |
| Kahoahuna | | | | 46.00 | | | | |
| Waipunalei, (private) | | | | | | 1,470.00 | | |
| Laupahoehoe - Weloka Forest | | | | *11,845.00 | | | | |
| Maulua, (private) | | | | | | 7,989.00 | | |

TABLE III—Continued—ISLAND OF HAWAII.

| RESERVE Name | LEASE Number | GOVERNMENT LANDS | | | | PRIVATE LANDS | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | Leased | | Not Leased | | | | |
| | | Acres | Acres | Acres | Acres | Acres | Acres | Acres |
| Hilo Forest Reserve—Con. | | | | | | | | |
| Waikaumalo—Maulua | | | | 790.00 | | | | |
| Piha | 442 | 3,780.00 | | | | | | |
| Nanue (private) | | | | | | 145.00 | | |
| Honohina (private) | | | | | | 5,555.00 | | |
| Opea-Peleau | | | | 230.00 | | | | |
| Umauma (private) | | | | | | 1,561.00 | | |
| Kamaee-Wailua | | | | 930.00 | | | | |
| Hakalau (private) | | | | | | 9,826.00 | | |
| Wailea-Kaiwiki | | | | 3,834.00 | | | | |
| Honomu-Kuhua Forest | | | | *926.00 | | | | |
| Makahanaloa (private) | | | | | | 3,949.00 | | |
| Onomea " | | | | | | 773.00 | | |
| Kahalii " | | | | | | 183.00 | | |
| Papaikou " | | | | | | 10,269.00 | | |
| Pahoehoe " | | | | | | 176.00 | | |
| Paukaa " | | | | | | 6,221.00 | | |
| Kikala " | | | | | | 90.00 | | |
| Kalalau " | | | | | | 918.00 | | |
| Puueo (private) | | | | | | 436.00 | | |

TABLE III—Continued—ISLAND OF HAWAII.

| Reserve Name | Lease Number | Government Lands | | | | Private Lands | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Leased | | Not Leased | | | | |
| | | Acres | Acres | Acres | Acres | Acres | Acres | Acres |
| Hilo Forest Reserve—Con. | | | | | | | | |
| Piihonua | 103 | 33,941.00 | | | | | | |
| Punahoa (private) | | | | | | 216.00 | | |
| | | | 41,622.00 | | 18,601.00 | | 49,777.00 | 110,000.00 |
| Honuaula Forest Reserve— | | | | | | | | |
| Honuaula | | | | *665.00 | | | | |
| | | | | | *665.00 | | | 665.00 |
| Kau Forest Reserve— | | | | | | | | |
| Puumakaa-Kiolakaa Forest | 550 | 5,750.00 | | | | | | |
| Waiohinu | 151 | 10,740.00 | | | | | | |
| Kahilipalinui (private) | | | | | | 165.00 | | |
| Kawala-Kaunamano | | | | *380.00 | | | | |
| Kioloku | | | | *216.00 | | | | |
| Hionaa-Hokukano Mauka | | | | *345.00 | | | | |
| Kaalaiki Forest | | | | *10,705.00 | | | | |
| Hilea-nui (private) | | | | | | 2,620.00 | | |
| Hilea-iki " | | | | | | 37.00 | | |
| Ninole-Wailau Forest | | | | *5,680.00 | | | | |
| Punaluu (private) | | | | | | 1,275.00 | | |

TABLE III—Concluded—ISLAND OF HAWAII.

| Reserve Name | Lease Number | Government Lands | | | | Private Lands | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Leased | | Not Leased | | | | |
| | | Acres | Acres | Acres | Acres | Acres | Acres | Acres |
| Kau Forest Reserve—Con. | | | | | | | | |
| Mohokea, 1 and 2 | 454 | *1,875.86 | | | | | | |
| Moaula-Kopu-Makaka, Mauka | 578 | 46.40 | | *7,379.74 | | | | |
| Paauau 2 (private) | | | | | | 1,675.00 | | |
| Kaauhuhuula Forest | | | | *2,332.00 | | | | |
| Keaiwa (private) | | | | | | 460.00 | | |
| Kaalaala-Makakupu Forest | 555 | 7,122.00 | | | | | | |
| Kapapala | 106 | *7,046.00 | | | | | | |
| | | | 32,580.26 | | *27,037.74 | | 6,232.00 | 65,850.00 |
| Total, Hawaii | | | 74,402.26 | | 62,436.94 | | 58,615.80 | 195,455.00 |

* Government lands set apart by proclamation as forest reserves.
Leased lands marked * are set apart under the two-year limit of expiration of lease clause..
W. R.—Water rights only are leased.
For additional information regarding leased lands see "List of Public Lands," issued by the Land Department.

# TABLE IV.

## AREAS OF LANDS IN FOREST RESERVES.

(Corrected to December 31, 1906.)

Prepared by the Survey Department.

*SUMMARY.*

### RECAPITULATION

BY ISLANDS

### ISLAND OF KAUAI.

| | Acres | Acres |
|---|---|---|
| Halelea Forest Reserve: | | |
| Government Lands, not Leased .... | 10,990.00 | |
| Private Lands .... | 26,510.00 | |
| | | 37,500.00 |
| Kealia Forest Reserve: | | |
| Government Lands, Leased .... | 7,385.00 | |
| Private Lands .... | 2,550.00 | |
| | | 9,935.00 |
| Total .... | | 47,435.00 |

### ISLAND OF OAHU.

| | | |
|---|---|---|
| Kaipapau Forest Reserve: | | |
| Government Lands, not Leased ... | 913.00 | |
| | | 913.00 |
| Ewa Forest Reserve: | | |
| Government Lands, Leased .... | 383.00 | |
| Government Lands, not Leased .... | 4,768.00 | |
| Private Lands .... | 23,399.00 | |
| | | 28,550.00 |
| Waianae-kai Forest Reserve: | | |
| Government Lands, Leased ... | 3,150.00 | |
| Private Lands .... | 106.80 | |
| | | 3,256.80 |
| Lualualei Forest Reserve: | | |
| Government Lands, not Leased .... | 3,743.00 | |
| | | 3,743.00 |
| Total .... | | 36,462.80 |

## ISLAND OF MAUI.

| | | |
|---|---|---|
| Koolau Forest Reserve: | | |
| Government Lands, Leased | 15,930.00 | |
| Government Lands, not Leased | 14,300.00 | |
| Private Lands | 12,739.00 | |
| | | 42,969.00 |
| Hana Forest Reserve: | | |
| Government Lands, Leased | 7,013.00 | |
| Government Lands, not Leased | 6,754.00 | |
| Private Lands | 1,058.00 | |
| | | 14,825.00 |
| Total | | 57,794.00 |

## ISLAND OF HAWAII.

| | | |
|---|---|---|
| Hamakua Pali Forest Reserve: | | |
| Government Lands, Leased | 200.00 | |
| Government Lands, not Leased | 16,133.20 | |
| Private Lands | 2,606.80 | |
| | | 18,940.00 |
| Hilo Forest Reserve: | | |
| Government Lands, Leased | 41,622.00 | |
| Government Lands, not Leased | 18,601.00 | |
| Private Lands | 49,777.00 | |
| | | 110,000.00 |
| Honuaula Forest Reserve: | | |
| Government Lands, not Leased | 665.00 | |
| | | 665.00 |
| Kau Forest Reserve: | | |
| Government Lands, Leased | 32,580.26 | |
| Government Lands, not Leased | 27,037.74 | |
| Private Lands | 6,232.00 | |
| | | 65,850.00 |
| Total | | 195,455.00 |

## *GRAND SUMMARY*

BY ISLANDS

| | Acres | Acres |
|---|---|---|
| ISLAND OF KAUAI— | | |
| Leased | 7,385.00 | |
| Not Leased | 10,990.00 | |
| Private | 29,060.00 | |
| | | 47,435.00 |
| ISLAND OF OAHU— | | |
| Leased | 3,533.00 | |
| Not Leased | 9,424.00 | |
| Private | 23,505.80 | |
| | | 36,462.80 |
| ISLAND OF MAUI— | | |
| Leased | 22,943.00 | |
| Not Leased | 21,054.00 | |
| Private | 13,797.00 | |
| | | 57,794.00 |
| ISLAND OF HAWAII— | | |
| Leased | 74,402.26 | |
| Not Leased | 62,436.94 | |
| Private | 58,615.80 | |
| | | 195,455.00 |
| | | 337,146.80 |

BY CLASSES OF LAND

| Islands | GOVERNMENT LANDS | | PRIVATE LANDS |
|---|---|---|---|
| | Leased | Not Leas'd | |
| | Acres | Acres | Acres |
| Kauai | 7,385.00 | 10,990;00 | 29,060.00 |
| Oahu | 3,533.00 | 9,424.00 | 23,505.80 |
| Maui | 22,943.00 | 21,054.00 | 13,797.00 |
| Hawaii | 74,402.26 | 62,436.94 | 58,615.80 |
| | 108,263.26 | 103,904.94 | 124,978.60 |
| | | 337,146.80 | |

*Acknowledgment.*

Apropos of these tables I would this year again express my appreciation of the assistance given this Department by the Survey Office. Mr. Wall has taken an active interest in the forest reserves and in detailing members of his staff, particularly Messrs. F. E. Harvey, G. F. Wright and R. D. King, to do forest work, has enabled me to bring to completion several projects that would otherwise have been delayed into 1907.

*Proposed Amendment of Forest Law.*

As was pointed out at some length in the 1905 report the forest laws should be so amended as to permit the Governor to set apart all government lands within the boundaries of established forest reserves, whether or not they are under lease; it being provided in the case of leased lands that the reservation be subject to the terms of the lease and not effective until the expiration thereof. Such an amendment would materially strengthen the forest reserve policy.

FOREST RESERVE MONUMENTS.

To properly and permanently mark the main points along the forest reserve boundaries, metallic forest reserve monuments have been manufactured, consisting of two galvanized iron pipes, each 4½ feet long, and respectively 2½ and 3 inches in diameter. The smaller pipe is set in the ground, the larger fitting over it and held in place by a bolt secured by a brass railway switch padlock. The upper pipe carries a metal target with the letters F. R. T. H. (Forest Reserve, Territory of Hawaii). When set in place the monument is given a coat of white enamel paint. The upper pipe being detachable permits the use of the point as a station in survey work.

During 1906 sixty-nine forest reserve monuments were erected on the boundaries of eight forest reserves. Distributed by islands, the list of monuments is as follows: Kauai 29, Oahu 17, Hawaii 23.

## FOREST EXTENSION.

The second main branch of the work of the Division of For-

estry is Forest Extension. This includes the cooperative assistance that the Division is prepared to render persons desiring to establish forest plantations or to conduct their forest work in accordance with the methods of forestry, and also the introduction and distribution of exotic and other seeds and plants of value to the Territory.

This Section is under the direct charge of Mr. David Haughs, Forest Nurseryman, whose own report should be consulted for the details of the work. Briefly summarized the accomplishments of the past year are as follows:

## COOPERATIVE ASSISTANCE.

Under the terms of Circular No. 1 of the Division of Forestry, issued in December, 1905, thirty-nine applications in all have been received for advice and assistance in forest planting. In answer to the more important of these requests Mr. Haughs has made five trips during the year to the other islands and three to points on Oahu, during which he has visited and examined nineteen tracts. In most cases the suggestions made verbally while going over the ground have been followed by a written report or by a detailed planting plan. Fourteen such reports have been prepared during 1906. Besides the applications for advice regarding large tracts, twenty persons in and around Honolulu have been given assistance of one sort or another in forest or nursery work, and a considerable number more have received information by letter, or in person during visits to the Nursery.

One of the most encouraging features of this work is the attitude taken by some of the large corporations. In undertaking forest planting these companies show a commendable foresight which will surely bring returns in later years, when the wood supply becomes an even more important factor than it is today.

In making the examinations the attempt is made so far as possible, to arrange that applicants in one part of the Territory shall be visited during one trip; in this way both time and expense are saved. On his trips to the other islands, Mr. Haughs has been able to gather much valuable information in regard to the success or failure of forest plantations started in former years. The systematic collection of data of this character is of great

importance, for when properly put together and published they give a definite basis on which to rest present forest work.

Properly included under this general head is a trip to Hawaii made by me in October to discuss on the ground with the manager of the company plans for logging the Koa timber on the Bishop Estate Tract of Keauhou, in Kau. This trip occupied ten days. On my return I appeared before the directors of the Hawaiian Mahogany Lumber Company and made a verbal report, approving the plan of operations outlined by Mr. E. H. Cant, the manager. The statement there made was also furnished Mr. Cant, in the form of a letter.

In reply to an application from the same company for a report upon the Koa in the Kona District on Hawaii, a report outlining the general policy of the Division of Forestry in regard to lumbering in Hawaii was prepared early in September. This report, approved by the Board, appeared in the Hawaiian Forester and Agriculturist for November, 1906.

*Press Bulletins.*

As an aid to tree planters, there was published in November, 1906, a four-page press bulletin by Mr. Haughs (Press Bulletin No. 4 of the Division of Forestry) entitled "Instructions for Propagating and Planting Forest Trees." This leaflet describes in a concise way the methods which should be followed in the nursery and in the field to secure success in tree planting.

Earlier in the year, in February, a "Revised List of the Forest and Ornamental Tree Seed for Sale at the Government Nursery" was issued as Press Bulletin No. 3 of the Division of Forestry. Both these are intended to be used with, and to supplement Circular No. 1, the "Offer of Practical Assistance to Tree Planters."

## COLLECTION, SALE AND DISTRIBUTION OF SEED AND PLANTS.

The past year has also seen an advance in the matter of seed collection and distribution. The local work has been further systematized so that now seed of all the more important native and introduced trees is collected as it becomes ripe and kept on sale at very moderate prices. Whenever possible it is the

intention to collect seed from Hawaiian grown trees rather than to import it, thus at once securing fresh seed and profiting by any advantage that may come from acclimatization. But unfortunately not all of the introduced trees are yet in bearing, nor do all those that are, produce seed regularly. In such cases it is the aim of the Division to import and keep on hand enough seed to satisfy the probable demand.

In the introduction of seed of new or little known exotic plants the present year has seen a marked development, not so much in actual receipts as in the perfection of arrangements to exchange with botanic gardens and other similar institutions in various parts of the world, especially in the tropics. Collections of native Hawaiian seeds made for the Division of Forestry have been sent to a number of these institutions, in return for which it is expected that valuable additions to the stock will be received.

As has been pointed out in earlier reports the introduction of new trees is one of the most important lines of work to be taken up in the Territory. It is capable of almost unlimited expansion and later should be given a prominent place in the activities of the Division. For the present it is believed that the greatest amount of good to the Territory will result from following up the offer of cooperative assistance. Later, the Division of Forestry can well leave the planting of private lands wholly to the private owner and devote its attention to more technical forest work.

*Free Distribution of Seed and Plants.*

The sale of seed and plants from the Government Nursery resulted during 1907 in the realization of $291.28. This sum was turned into the General Treasury of the Territory.

Free distribution of seed and especially of plants to schools and to improvement clubs has been continued. For Arbor Day, November 2nd, 1906, 2,580 plants were distributed. During the remainder of the year 7,177 more plants were given to homesteaders, improvement clubs, schools and others; in all a total of 9,757 plants given gratis.

## RUBBER EXPERIMENTS.

The wording of the item appropriating money for the current expenses of the Board of Agriculture and Forestry for the present fiscal period makes mandatory "experimenting in growing rubber trees on government forest lands."

In compliance with this law and in response to a general demand for such information, the Division of Forestry has undertaken three kinds of rubber experiments: (1) A systematic trial of Ceara Rubber (*Manihot glaziovii*) in various localities throughout the Territory to ascertain definitely where this species will and will not grow; (2) The importation of seed or seedlings of other rubber producing trees, followed by propagation and distribution; and (3) Systematic experiments in tapping rubber trees that have reached sufficient size to be so treated.

In the Ceara experiment sample lots, usually of 25 seed each, were sent to ninety-four persons, who agreed to report from time to time upon the growth of the trees and other facts of interest. In a few cases where exceptionally favorable conditions for the experiment obtained larger quantities were given. In reply to a card of inquiry, figures are now being received showing the height and diameter which the trees have attained in six months. These figures will be tabulated and soon published in the form of a circular.

After several unsuccessful attempts to secure seed or plants of the Para and Central American species (*Hevea brasiliensis*) and (*Castilla lactiflua*) respectively, plants of both kinds are now being propagated at the Government Nursery. These will eventually be placed in various situations where they can be watched and noted. The Castilla seed was purchased in Ceylon through Mr. Jared G. Smith. The Para plants are from a consignment of stumps that arrived at this port in such poor condition that the consignees refused to accept it. The plants were accordingly put up at auction by the Customs officials. They were bid in by Mr. Alexander Craw, Superintendent of Entomology, who turned them over to this Division. Although in very unpromising condition when received, by careful attention many have been saved and are now doing well.

The most important question in connection with the rubber

industry in Hawaii is whether or not the trees will yield rubber in commercial quantities. This is, of course, the vital point in the whole matter and until it is demonstrated one way or the other, the industry must remain in the experimental stage. In connection with the investigation of the planted forest at Lihue, made during the past summer by the Division of Forestry, the attention of the public was brought to two groves of Ceara Rubber trees of sufficient size to tap. Arrangements were at once made for careful experiments to determine the yield of these trees. These experiments will soon be begun and will be carried on under the joint direction of this Division and the Federal Agricultural Experiment Station, as that office has a man available to conduct the experiment and this Board has not. The results of this work will be made public as soon as enough definite information is obtained to warrant publication.

The Ceara groves at Lihue are the only ones in the Territory where enough trees of the necessary age and size are to be found to make the results of value. Each grove contains about fifty trees large enough to tap.

## NUUANU VALLEY.

The work of the Division of Forestry in Nuuanu Valley during 1906 as for two preceding years, has consisted in caring for the forest plantations already established rather than in planting more trees. It is gratifying to note that the care that has been given the young trees is now bearing fruit in their sturdy appearance and thrifty habit. Especially is this seen in the lower part of the plantation, but even where more exposed to the wind the trees are now making a satisfactory growth. Two laborers are kept at the Forester's cottage to look after the Nuuanu work. This arrangement will be continued during the coming year.

## TANTALUS FOREST.

The most notable feature of the past year in connection with Tantalus is the greater protection that has been afforded both the planted forest and the native growth higher up by the forest ranger who, since March, has made a daily round of the section. Owing to the occurrence of several small forest fires

on Tantalus early in the year, a period of special fire danger for the Tantalus District was declared under date of February 8, and since then permits have been required for the burning of brush. In each case where a permit is given the ranger personally supervises the burning and sees that it is done properly. In a report upon his district the local fire warden, Mr. W. M. Giffard, says:

"I consider that the absence of forest fires in the Tantalus section and its immediate neighborhood during the excessively dry period we have had, is due to the regulations established by the Commissioners of Forestry, whereby a forest police ranger was appointed and the numerous lot owners in the residential section of Tantalus were requested to secure permits from the District Fire Warden before they were allowed to burn off brush on their premises. The Forest Police Ranger has faithfully attended to the carrying out of the regulations, and as no two permits were ever granted for the same day, he has been able to personally supervise the burning of rubbish and brush for which permits were applied. The carelessness of the overseers in charge of these premises in the past in allowing a burning pile of brush, etc., to take care of itself, while they either left the premises or attended to other work, was the cause of practically all of the fires which have occurred on Tantalus in recent years. The presence of the Forest Police Ranger has a salutary effect on these overseers, all of whom are Japanese, for they are now compelled to stay by the burning piles of brush so long as any fire remains.

"During the period named, the District Fire Warden has issued thirty-one permits to the property owners in the district for the burning of brush fires. The Ranger reports that there has been only one infingement of the regulations since these were established, which would tend to show that the property owners in this district are, as a whole, inclined to coöperate with the Department.

"In addition to his daily duties of policing the forest section of Tantalus and Makiki, the Forest Ranger has cut several miles of trails through the thickest of forest undergrowth, in

order to allow access to the upper ranges in case of fires starting there during dry weather. He has furthermore protected from destruction much undergrowth and many young trees which in the past have been, to a very great extent, ruthlessly destroyed by pleasure seekers."

The acquisition by the Territory of the Coney Estate property on Tantalus, on which is the larger part of the Eucalyptus forest, has not yet taken place, but during the year some progress has been made looking thereto. It is earnestly to be hoped that by an equitable exchange this tract can be secured by the Government.

## MISCELLANEOUS FOREST WORK.

With an increased appropriation and a large staff the Division of Forestry could undertake much work of benefit to the Territory which can now be given only aggravatingly scant attention.

But even under the present conditions there are gradually being accumulated materials for the collections needed for reference or that illustrate the forest work. Additions to the herbarium, to the reference collection of native and exotic seed, and to the forest photographs have been made during the year, and more notes have been taken on the times and duration of the period during which the important trees and shrubs are in flower and fruit.

### INVESTIGATION OF THE PLANTED FOREST AT LIHUE.

Perhaps the most important thing to be recorded under the head of miscellaneous forest work is the investigation of the planted forest at Lihue, Kauai, undertaken during the summer of 1906, under the immediate charge of Mr. Charles S. Judd, of Honolulu, a senior in the Yale Forest School, who was appointed Special Forest Agent in the Division of Forestry for a temporary period of two months and a half (July 23 to September 30). The investigation consisted in the careful measurement of the trees on sample plots in the various types of planted forest on the lands of the Lihue Plantation

Company and of Grove Farm. From the data collected can be compiled tables of volume and yield—which based on what this forest has produced, may be used in computing what may be expected from other plantations of the same species grown under similar conditions.

The results of the investigation will appear as a bulletin of the Division of Forestry. This is now being prepared.

## PUBLICATIONS.

One of the ways in which the Division of Forestry makes its work of value to the Territory is by issuing publications dealing with various phases of forestry in the islands.

The list of publications of the Division of Forestry issued during 1906 is a short one, the preparation of several circulars which it was expected could be published during the year having been unavoidably delayed. It is as follows:

Press Bulletin No. 3. A "Revised List of the Forest and Ornamental Tree Seed for Sale at the Government Nursery," 4 pp. Issued February, 1906. (1,500 copies.)

Press Bulletin No. 4. "Instructions for Propagating and Planting Forest Trees," by David Haughs. 4 pp. Issued November, 1906. (1,000 copies.)

Report of the Division of Forestry for the year ending December 31, 1905. (Reprinted from the Second Report of the Board of Commissioners of Agriculture and Forestry.) Issued Novmber, 1906. (500 copies.)

## REPORTS AND OCCASIONAL PAPERS.

During 1906 routine reports outlining the work of the Division of Forestry have been submitted at each regular meeting of the Board. These are subsequently published in the Hawaiian Forester and Agriculturist. The Forest Nurseryman has also submitted weekly reports covering in more detail what has taken place in his section.

Special reports and papers on forestry in Hawaii have, by request, been prepared by the Superintendent of Forestry for publication in the annual report of the Governor to the Secre-

tary of the Interior, and for delivery before the Honolulu High School on Arbor Day, and before the Hawaiian Sugar Planters' Association at its annual meeting.

An address on "Some Forest Problems in Hawaii" was delivered by the Superintendent of Forestry, in Washington, D. C., in April, before the national organization of professional foresters, The Society of American Foresters.

## EXHIBIT AT THE POULTRY SHOW.

On December 20 to 22 the Hawaiian Poultry Association held its annual exhibition in Honolulu, this year with the coöperation of the Farmers' Institute and the Board of Agriculture and Forestry.

The exhibit made by the Division of Forestry attracted a due share of attention and elicited considerable favorable comment. It consisted of a series of maps and charts showing the location and area of the established forest reserves; a collection of seed and seedlings of forest trees and other plants, illustrating the methods in use at the Government Nursery; examples of the forest fire and other warning notices, printed on cloth for posting along the forest reserve boundaries and elsewhere in the Territory; and a forest reserve boundary monument, used to mark the important points on the reserve lines. A case containing the publications of the Board also formed a part of the exhibit and packages of various circulars and press bulletins of the several divisions were left in trays for free distribution.

The space allotted to the Division consisted of a four-foot wide table about thirty-five feet in length, with a wall space behind, corresponding in length to the table.

The maps used in the exhibit were especially prepared for the purpose by the Government Survey Office. They were based on the maps made to accompany the report of the Governor to the Secretary of the Interior, for the year ending June 30, 1906. The maps and charts are now hung in the office of the Board.

## DISTRICT FORESTERS.

During 1906 the following changes have taken place in the personnel of the corps of District Foresters:

*Resignations.*

Resignations have been received from Messrs. F. W. Carter of South Kohala, Hawaii, and G. C. Munro of Molokai, because of change of residence; and from Mr. C. Bolte of Koolaupoko, Oahu, because through change of ownership he was no longer directly interested in that section.

*Appointments.*

To succeed those resigning the following gentlemen were appointed: Mr. E. E. Conant to succeed Mr. Carter; Mr. James Munro to succeed his brother, and Mr. W. C. Weedon to succeed Mr. Bolte. Mr. T. S. Kay was also appointed, in February, to the position left vacant by the resignation of Mr. E. E. Olding of Kohala, in the latter part of 1905.

The new appointments are as follows: *Kauai,* Messrs. A. F. Knudsen, Walter D. McBryde and Edward Broadbent; *Molokai,* east end, Mr. C. C. Conradt; *Maui,* Mr. C. J. Austin.

In each case but one the new appointees have districts resulting from the breaking up of larger ones. This has, of course, necessitated a change of boundaries with other district foresters than those named. On another page of this report will be found a corrected list of all the district foresters, with their respective jurisdictions. The list numbers forty names.

Interesting reports have been received from a majority of the district foresters. These are printed elsewhere in this volume.

## FOREST FIRE SERVICE.

Fortunately the past year has been relatively free from forest fires and those that have occurred have been checked in season to prevent any great damage. The freedom from fire is without question due in part, if not in large part, to the forest fire law enacted by the Legislature of 1905. The knowledge that there existed a law providing penalties for damage resulting from the careless use of fire, behind which stood a branch of the Government, represented locally by the district fire wardens, ready to see that the law was enforced has had unques-

tionably a salutary influence on the class of persons to whose doors forest fires can usually be traced.

In connection with this statement the following resolution, adopted by the Board of Agriculture and Forestry on March 22, 1906, may be cited:

"Resolved, that the Superintendent of Forestry be, and he is hereby instructed, without further action by the Board, upon each occasion when brush or forest fires take place, to make investigations, either in person or through the local fire wardens, as to the origin of each such fire; and if in any case the facts appear to warrant further investigation or prosecution, to request the assistance of the appropriate police authorities and prosecuting attorneys to secure evidence and prosecute the persons found responsible for such fires."

## PERIOD OF SPECIAL FIRE DANGER.

As a result of the prolonged dry weather early in the year advantage was taken in three cases of the section of the Forest Fire Law (Section 6, Act 71 of the Sessions Laws of 1905), which provides that in times or localities of particular fire danger a special warning may be issued, that during a specified time fires to burn brush, etc., shall not be started unless the written permission of the District Fire Warden shall have been first obtained. Acting under this authority the Chief Fire Warden issued special warnings as follows:

For a portion of the Waialua District, Island of Oahu, for a period of six months from March 7, 1906;

For a portion of the Ewa District, Island of Oahu, for a period of six months from March 17, 1906; and

For a portion of the Waianae District, Island of Oahu, for a period of six months from March 23, 1906.

There was also issued on February 8, 1906, for the period of 12 months, a special warning covering the section between Manoa and Pauoa Valleys in the District of Kona, on Oahu. This includes Tantalus Heights and the planted forest below.

Permits to burn brush under these special warnings were isued as follows: Waialua none; Ewa, one; Waianae, none; and Tantalus, to November 30, 1906, thirty-one.

Special warning notices in English, Hawaiian, Portuguese and Japanese were printed on cloth and posted in each of these four districts, calling attention to the period of special danger. The regular fire warning notices have been kept in evidence throughout the Territory.

## RECORD OF THE YEAR'S FIRES.

In answer to a letter from the Chief Fire Warden requesting data in relation to forest fires from January 1 to November 30, 1906, letters have been received from 37 out of the 50 district fire wardens.

From the information so received and from data already in the office the following list has been prepared ,which is believed to be a practically complete record of the forest fires of 1906, certainly of all the important ones. Twenty-five fires are recorded in the list.

*February 5, Tantalus Heights, Kona, Oahu.*

Grass fire, 3 to 5 acres. Started from a fire for burning brush on the lot owned by Hon. C. H. Dickey. Stopped just before it got to the edge of the forest. Fifteen men called out. The men from the Government Nursery were paid $6.00 by the Board. The rest were paid by Senator Dickey.

*February 13, Tantalus Heights, Kona, Oahu.*

Heavy smoke from several piles of burning brush on the property of Mr. T. Clive Davies made it appear from town that a big fire had started on Tantalus. A force of 22 men was accordingly sent up to fight it. No damage, except loss of time and expense of the men called out. This fire cost the Board $9.50.

*March 3, Grant 973, Waialua, Oahu.*

Grass fire, 25 acres. Probably set to burn off dead grass and improve pasture. Put out by a Waialua Agricultural Company luna and three laborers. No damage was done, but says the District Fire Warden, "Had the fire got half an hour's' better start I believe it would have been as disastrous as the Wahiawa fire of March, 1905."

*March 7, Paauhau, Hamakua, Hawaii.*

Brush and grass fire in open and largely burned over forest on land owned by the Parker Ranch. About 1,000 acres. This fire was started by sparks carried by a sudden and severe Kona wind storm from brush fires for burning German ivy. The clearing of ivy had been going on for four months under proper precautions and except for the sudden wind there would have been no danger. A large gang of men was at once set to work and aided by rains checked the fire and the next day had it under control. Paauhau Sugar Plantation had 300 men at work for one day protecting the upper cane fields from the fire beside others who assisted the Parker Ranch gang in keeping the fire within certain bounds.

As most of the area burned over had been severely injured by previous fires the direct loss from this fire was mainly the expense for labor. This fell on the Parker Ranch and on the Paauhau Sugar Plantation Company. The expense to the latter is estimated at $250.00.

*March 7, Pakua Hill, Hilea, Kau, Hawaii.*

On the night of March 7, a fire burned off the forest on the top of the Pakua Mauka Hill and also 23 acres of cane on Makanau Hill, directly makai. The fire is supposed to have started from the house of a Chinese taro planter. The plantation called out a force of 473 men to extinguish this fire, at a cost of $376.05. Hard work got it out about noon on March 8. The District Fire Warden says, "It was only by great and repeated efforts that the flames were prevented from escaping into the Ninole and Kaalaiki hills, from whence they would have spread over the whole mountain side, as the woods had been dry as tinder for weeks."

*March 7, Puu Oo, Piihonua, Hilo, Hawaii.*

On the morning of March 7, two fires were discovered on Mr. W. H. Shipman's ranch; one about half a mile below the Puu Oo house, the other about two miles away toward Halealoha. The ranch men at once started out to fight the fire, but the strong Kona

wind hindered the work and the two fires met near Mr. Shipman's line fence and burned over a considerable area; just how much is not stated. As the country burned over was mainly outside the heavy forest the damage was comparatively slight, but the cost of replacing the fences burnt amounted to about $1,000. Certain signs pointed to this fire being of incendiary origin, but no definite evidence could be secured.

*March 7, Punahawai, Hilo, Hawaii.*

Brush and grass fire, escaped during the Kona storm from a homesteader clearing land. One hundred and twenty-five acres of pasture land owned by the Hilo Sugar Company were burned over. There was no particular damage, as the 40 men called out soon had the fire under control.

*March 7, Kukuau 2nd, Hilo, Hawaii.*

Brush fire on homestead lot. Burned for two nights and one day, but was controlled without damage to other property.

*March 8, Kamae Homesteads, Hilo, Hawaii.*

What might easily have been a disastrous forest fire was prevented by the prompt action of the Hakalau Plantation in stopping a fire that started from fires to clear land on the Kamae Homesteads at the time of the Kona storm. Three hundred men were called out and worked for one day, while for two days longer 30 men remained on duty until the fire was entirely extinguished. The expenses incurred in fighting this fire were paid by the Hakalau Plantation Company.

*March 9, Hilo District, Hawaii.*

Messrs. W. G. Irwin & Company, under the date of March 19, reported that in addition to the fires recorded on March 7, 8 and 9, "several of our managers have reported fires on Waiakea, Onomea and Honomu. On the dates named at the latter place, as in most of the others, the cause was the homesteaders clearing and burning brush without apparently using any discretion as to conditions of weather or prevailing winds." These fires could not have been

important as the District Fire Warden for the Onomea section, Mr. J. T. Moir, says that he has no fires to report during the year.

*March 11, Palolo Valley, Kona, Oahu.*

A grass fire of about 5 acres, on homestead lot No. 16, owned by Mr. Edward Stone, started by children playing with matches in the dry grass. Mr. Stone, assisted by Mr. Charles Hau, owner of a neighboring lot, began to fight the fire as soon as discovered. Soon after, Mr. Haughs arrived on the scene with one man from the Nursery and eleven from the Road Board. After a hard fight of four hours the fire was stopped before it reached the forest. The wages of the laborers at this fire amounted to $25.00; this was paid by the Board.

*March 12, Waiakea, Puna, Hawaii.*

Grass fire on Waiakea near the beach; about 75 acres burned. Went out as the wind died down; no damage.

*March 18, Honokua, Kona, Hawaii.*

Forest fire of about 75 acres on the privately owned land of Honokua, at an elevation of about 5,800 feet. The forest was scrubby Koa and Ohia and the damage was regarded as nominal. The fire burned for about ten days and was finally put out by rains. Cause, unknown.

*March 30, Nuuanu Valley, Kona, Oahu.*

Mr. Haughs, with four laborers from the Nursery, answered a fire call that proved to be a fire in the dwelling house occupied by Mr. W. C. Kapulani. From the appearance of the smoke it looked as if the fire were further up the valley, in the forest.

*May 20, Hanalei, Halelea, Kauai.*

A small grass fire started by some Chinamen burning rice straw was spreading rapidly toward the forest when put out by a heavy shower. No damage.

*July 24, Nuuanu Valley, Kona, Oahu.*

A brush fire on the slopes below Pacific Heights was successfully fought and extinguished on the evening of July 24 by Mr. Haughs and three laborers. The area burned over was covered by guava, lantana and grass. No clue could be found regarding the origin of this fire. The cost to the Board of fighting it was $4.00.

*August 2, Wahiawa, Waialua, Oahu.*

Grass fire of about 2 acres; cause unknown, but thought to be due either to cattlemen or to Japanese charcoal burners. Put out by Mr. A. Anderson and five men employed by the Wahiawa Water Company—the same luna who put out the fire in March on neighboring lands. No damage.

*August 12, Halemanu, Waimea, Kona, Kauai.*

Grass and brush fire, 4 acres. Started from sparks from a smouldering stump, in a fire to clear land. Stopped by residents and laborers from near-by mountain camps before any serious damage had resulted.

*August 16, Country Club, Nuuanu Valley, Kona, Oahu.*

A brush and grass fire that might have assumed serious proportions occurred on the hill side above the Country Club on the afternoon of August 16, starting from piles of burning brush left unwatched. The fire was put out by a gang of seven men from the Government Nursery, assisted, when the fire was almost out, by a gang of 20 men from the Road Department. The expense thus incurred, $57.50, was borne by the Country Club.

*August, Waimea, Kona, Kauai.*

Two grass fires occurred in August on the western side of the Waimea Valley, started by sparks from blasting on the new Waimea ditch. They were put out without any particular damage being done.

*September 9, Olomano, Koolaupoko, Oahu.*

Brush fire, of about 500 acres, supposed to have been started from a cigar stub or cigarette dropped by some unknown person into dry grass. The fire was stopped by a gang of 14 men from the Maunawili Ranch, under the direction of the local fire warden, Mr. John Herd. The men worked for 6 hours. The cost, $21.00, was borne by the ranch. Fortunately the fire was stopped before it got to the forest, so that the loss of a number of fence posts was the most serious damage. Mr. Herd says, "Had not the laboring force of the Maunawili Ranch been available this fire might have extended itself into the Kailua watershed and the upper Waimanalo cane fields."

*September, Waiohinu, Kau, Hawaii.*

A brush fire of about 40 acres occurred in the fern growth near the edge of the forest on Waiohinu. Supposed to have been caused by some careless smoker. About 20 men turned out from Waiohinu and Naalehu and worked for a couple of hours to put it out. They received no pay, so far as the local fire warden knows.

*October, Wahiawa, Waialua, Oahu.*

A brush and grass fire of a few acres, supposed to have been started by a careless smoker, occurred in the gulch at Wahiawa, back of the settlement, early in October. It was put out by Mr. B. O. Clark, with six other men from the Colony and two Japanese. Stopped before any particular damage was done.

*December, Kawaihae, N. Kohala, Hawaii.*

A brush and grass fire was reported on the grazing land of Kawaihae 1, cause unknown. Put out by Parker Ranch employees.

*December, Puna, Hawaii.*

Several grass fires are reported as having occurred during the year on grazing lands in Puna. The damage appears to have been slight.

From the above statements it will be seen that in a number of cases only prompt and determined action prevented an incipient fire from spreading over considerable areas of forest and doing much damage. If of value in no other way the forest fire law has brought home to many persons the fact that a forest fire is a danger not to be lightly disregarded, in itself an important step toward the awakening of an intelligent public sentiment. The reports of the fire wardens show, too, that the men who hold the position are not merely nominal appointees, but active agents in seeing that the law is enforced.

*What the Fire Wardens Say.*

The following extracts from the letters of certain of the fire wardens are quoted because the points brought out are of general interest in connection with this subject.

Mr. Walter F. Dillingham, Ewa, Oahu.

"In view of the fact that during the prescribed fire danger period there were no forest fires in this district, I am led to believe that the regulations in regard to the matter have worked satisfactorily."

Mr. A. Horner, Hamakua, Hawaii.

"I am pleased to be able to report no forest fires in this district the past year. * * * Since the experience with the fires of 1901 the homesteaders have been very careful when burning off. You will likely remember that all fires in 1901 originated in the homesteads."

Mr. James Gibb, Hamakua, Hawaii.

"Considering that five months of the present year have been very dry, we think this district has been very fortunate in having but one fire. We are inclined to think that the vigilance now maintained over the forests of the Territory by the Board of Agriculture and Forestry has made the people in general more careful with fire."

Mr. G. W. McDougall, South Kona, Hawaii.

"If it is the intention of the Government to keep the forest from being destroyed by fire, there will have to be an appropriation for this work, and each fire warden ought to be authorized and allowed to spend fifty or a hundred dollars, to fight fire, at very start of same, i. e. if on government land. By this mode large areas and large expenses can be cut out from being injured, and spent."

## POLICY IN REGARD TO FIRE CLAIMS.

Significant action was taken in three cases where bills for expense incurred in fighting forest fires were referred to the Board of Agriculture and Forestry for payment, in that a precedent was thereby established, which will guide future cases. It is the judgment of the Board, expressed at a meeting held on March 22, 1906, "that owners or lessees of fee simple land, and lessees of government land should protect the same from fire at their own expense."

### *Lack of Appropriation.*

It will be remembered that a bill to appropriate $5,000.00 per annum to be used only in cases of emergency, and expended only with the approval of the Governor, was introduced at the last session of the Legislature and failed to pass. Some arrangement should be made at the coming session to provide an appropriation that can be drawn on to combat fires on government land or on private land where if the fire spreads it will endangegr overnment property. As it is now there is no provision for the payment of fire fighting of any kind; a condition which to say the least is highly unsatisfactory.

## FIRE WARDENS.

A number of new district fire wardens have been appointed during the year so that now the chain of fire districts is practically complete on each of the islands. There are now fifty district fire wardens. A corrected list appears on another page of this report, giving the name and district of each warden.

## PROGRESS OF FORESTRY IN THE TERRITORY.

It has been the custom in past reports to make note of forest work other than that being carried on by the Division of Forestry. Perhaps the celebration of Arbor Day may be noted first under this head.

### ARBOR DAY.

By proclamation of the Governor, Nov, 2, 1906 was set apart as the second Arbor Day to be officially observed in Hawaii. While the interest was perhaps not so marked as in 1905, the observance of the day was general and spontaneous, showing conclusively that Arbor Day has come to stay.

The feature of special interest this year was the announcement of the prize winners in the tree planting contest begun on the first Arbor Day in 1905. Made possible by the money contributed by Governor Carter and others, a prize was offered to the grade in each public school planting a tree on Arbor Day, which, as the result of care, should be in the best condition at the end of the year. One hundred and twelve schools, out of a total of 154, qualified as prize winners. The prizes are now being procured under the direction of Mr. W. H. Babbitt, Superintendent of Public Instruction, and will be awarded early in 1907.

Credit should be given Mr. Babbitt for the real interest he has taken in this matter, for to secure a fair judgment and to arrange the necessary details of awarding the prizes, he has cheerfully given his personal attention to an unexpected amount of routine detail.

The Board of Education took an active part in this year's celebration of Arbor Day by paying the freight on the boxes of plants sent out by the Government Nursery to the public schools. This year 2,546 plants were furnished to 68 schools, as against 2,846 to 95 schools in 1905.

### KOA LUMBERING.

Two companies are now organized to lumber Koa in Hawaii: the Hawaiian Mahogany Lumber Company, Limited, operating

on the Bishop Estate land of Keauhou in Kau and the American Hawaiian Mahogany Lumber Company, operating in South Kona, both on the island of Hawaii. Neither company had begun actual work in the woods on Dec. 31, 1906, but both have taken many preliminary steps so that before long the logging can successfully begin. The similarity in name of the two companies is accidental. The former is an Hawaiian, the latter a California corporation.

## FOREST PLANTING.

An awakened interest in forest planting bids fair to become general on the larger sugar plantations. Much work has been done this year, both directly by the plantations and in coöperation with the Division of Forestry. The latter work has already been discussed; for details in regard to the former the reports of the District Foresters should be consulted, especially those of Mr. Walter D. McBryde, Mr. Louis von Tempsky and Dr. J. H. Raymond.

Mention has already been made of the reforestation of a portion of the Waianae-kai Forest Reserve, by The Waianae Company. It is again noted here because it is the first case where forest planting has been undertaken in a forest reserve.

## RUBBER.

The interest in rubber continues to increase in the Territory and has led to a number of rubber planting projects, several of which will doubtless result in additional rubber plantations. There is as yet little that can be said definitely about the ultimate success of the industry, but so far as can be judged the outlook is certainly promising.

During the year a number of rubber experts have visited the Territory, among them Dr. Pehr Olsson-Seffer, Director, La Zacualpa (Mexico) Botanical Station and Rubber Laboratory. In an interesting article, published in the Hawaiian Forester and Agriculturist for November, 1906, Dr. Olsson-Seffer discusses the rubber situation in Hawaii and gives his views on the types of rubber plants adapted to the local conditions.

## FUTURE PLANS AND RECOMMENDATIONS.

It is the intention to conduct the Division of Forestry during the year 1907 in conformity with the general program that has been followed for the past three years. The creation of forest reserves will go on until the chain of projected reserves is established, continuing until that time to hold the first place in the work of the Division.

Coöperation with private owners in the giving of advice and assistance to those desiring to undertake forest work will also be continued, and additional steps will be taken to arouse interest in tree planting or to stimulate the movement where it already exists.

The experiments with rubber producing trees will be continued and as far as may be the various minor activities of the Division will be carried on.

The use of the Government Nursery as a distributing center for forest trees will be continued, but the effort will constantly be made to encourage the establishment of local nurseries in connection with tree planting work. Ornamental plants will only be grown and distributed for the use of schools or improvement associations, except in the few cases where such plants cannot be obtained from the commercial nurserymen.

### RECOMMENDATIONS.

#### *Forest Rangers.*

The particular and pressing need of forest work in Hawaii today is the establishment of a corps of paid forest rangers, for the administration and proper protection of the forest reserves already created or that will be established during the coming year. While a larger force would be desirable and will ultimately be necessary, I think that with the appointment of twelve rangers much can be accomplished toward securing the adequate protection and care which is essential if the reserves are to fully realize the objects for which they are set apart.

Furthermore until the Government can assure him that it is prepared adequately to administer its forest property, the private owner will be slow to turn over his forest land to the Government for management. And until the greater part of the land within the boundaries of any given forest reserve is brought under one organic and systematic control, that reserve cannot be made of the greatest possible value to the Territory.

I accordingly most urgently recommend that every effort be made to secure an appropriation from the Legislature sufficient to enable the appointment of a force of forest rangers. It is a matter of extreme importance in the forest work of the Territory. It must be given attention.

*Amendments to the Forest Law.*

I again recommend that the section of the forest law, covering the creation of forest reserves be so amended as to permit the Governor to set apart government land within the boundaries of established forest reserves whether or not the lands are under lease, provided of course that on lands under lease the reservation be subject to the vested rights under the lease and actually take effect at its expiration. Such a modification of the existing law would, I believe, go far toward strengthening the reserve policy of the Territory.

I recommend that a law be enacted making better provision than at present exists for dealing with forest trespass. The statute of malicious injury at present invoked is not sufficient for many cases that have come up or that are likely to arise in connection with the forest reserves or other government forest land.

Provision should be made for a fund from which could be paid expenses incurred in fighting forest fires on government land or in cases where the fire, if not stopped, would spread over and cause damage to government property. Such a fund should only be used in emergencies and may be safeguarded by restrictions as to how it shall be expended, but it should unquestionably be provided.

With these changes in the law and with an appropriation sufficient to enable the work to be carried on in a systematic way, the Division of Forestry may hope to continue to achieve results of lasting benefit to the Territory and to the people of Hawaii.

Very respectfully,

RALPH S. HOSMER.
Superintendent of Forestry and
Chief Fire Warden.

# Report of Forest Nurseryman.

Honolulu, Dec. 31, 1906.

Ralph S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu.

Dear Sir:—I herewith submit a report of the work done at the Government Nursery, the Nuuanu Station and the Tantalus Forest, including the giving of advice and assistance and other matters, for the year ending December 31, 1906.

## THE NURSERY.

### COLLECTION OF SEED.

The collecting of tree and shrub seed has been continued during the seeding season, the principal supply having been collected in the neighborhood of Honolulu. Thirteen kinds of native tree seeds have been received from Mr. Robert Hind, Puuwaawaa, Hawaii, and several small donations of seed have been received from a number of people on different parts of the Islands.

### *Seed Received From Abroad.*

At different times during the year sample packages of seed have been received from Dr. F. Franceschi, Santa Barbara, California; W. S. Lyon, Horticulturist, Bureau of Agriculture, Manila, P. I.; E. A. Sterling, Assistant Forester, U. S. Forest Service; Wm. H. Mast, Assistant, Dismal River Forest Reserve; George W. Peavy, Assistant Forest Inspector, U. S. Forest Service; G. French, Nurseryman and Seedsman, Melbourne.

Packages of seed containing all the kinds on hand have been sent to a number of botanic gardens, experiment stations and others in different parts of the world.

*Congressional Vegetable Seed.*

During the month of January 15,550 packages of vegetable seed were received from the Hon. J. K. Kalanianaole for distribution. Each package contained from five to six kinds of seed in small packets.

There is no doubt that this lot of seed reached more families requiring them and did more good than any previous consignment, principally owing to the assistance given in the distribution by the Superintendent of Public Instruction. A circular letter was sent by Mr. W. H. Babbitt to the principal of each of the public schools of the Territory, asking them to give the number of families represented in each school. Each family desiring vegetable seed was then supplied with an assortment. A notice was also put in the daily papers, stating that vegetable seeds would be sent to any person in the Territory applying for them.

Following is the number of schools supplied, also the number of packages sent to each island:

| Islands. | Schools. | Packages. |
|---|---|---|
| Hawaii | 52 | 4,354 |
| Maui | 25 | 1,890 |
| Molokai | 4 | 406 |
| Lanai | 2 | 46 |
| Honolulu | 10 | 1,588 |
| Kauai | 12 | 1,190 |
| Oahu | 11 | 1,338 |
| Total | 116 | 10,812 |

The balance of the seed was distributed to persons calling at this office and others who applied for same by letter.

GROWING AND DISTRIBUTION OF PLANTS.

In addition to the growing and distribution of forest and street trees, which is the principal work under this head, considerable experimenting has been done in the propagation of rubber and various other seeds new to the Islands. One laborer has been regularly employed during the year in the routine work of plant growing and propagation.

Following are tables showing the number of plants given away and sold, and also those sent out for the Arbor Day planting:

*Given Gratis.*

| | Forest. | Fruit. | Ornamental. |
|---|---|---|---|
| Homesteaders | 501 | 62 | 66 |
| Improvement Clubs | 2,300 | 195 | 475 |
| Schools | 808 | ... | 196 |
| Parks | ... | ... | 240 |
| Others | 1,397 | 441 | 496 |
| | 5,006 | 698 | 1,473 |
| Number of plants given gratis | | | 7,177 |

ARBOR DAY.

Following is the number of plants sent out for Arbor Day planting, with the number of schools, by islands:

| Islands. | Schools. | Plants. |
|---|---|---|
| Oahu | 30 | 719 |
| Hawaii | 17 | 581 |
| Kauai | 4 | 53 |
| Maui | 13 | 472 |
| Molokai | 4 | 721 |
| | 68 | 2,546 |
| Others | | 34 |
| | | 2,580 |

*Sold.*

| Forest | Fruit | Ornamental | Total |
|---|---|---|---|
| 3,100 | 47 | 538 | 3,685 |

*Summary of Plants Distributed From the Nursery During the Year 1906.*

| | |
|---|---|
| Gratis | 7,177 |
| Arbor Day | 2,580 |
| Total Gratis | 9,757 |
| Sold | 3,685 |
| Total | 13,442 |

In addition to the above, about 30,000 seedling Ironwoods, *Casuarina equisetifolia,* in 50 boxes, grown at the Government Nursery, were sold to the Paauhau Plantation for planting on the strip of land along the sea beach, as recommended by the writer.

Under the same arrangement 5,000 seedlings have been started for the Oahu Railway and Land Company, as follows:

| | |
|---|---|
| Swamp Mahogany *(Eucalyptus robusta)* | 1,000 |
| Lemon Scented Gum *(Eucalyptus citriodora)* | 250 |
| Red Gum *(Eucalyptus rostrata)* | 250 |
| Koa *(Acacia Koa)* | 1,000 |
| High level Ironwood *(Casuarina quadrivalvis)* | 500 |
| Black Wattle *(Acacia decurrens)* | 500 |
| Monterey Cypress *(Cupressus macrocarpa)* | 500 |
| Silk Oak *(Grevillea robusta)* | 1,000 |
| | 5,000 |

*Realization.*

During the year there has been collected and deposited with the Treasurer of the Territory as a government realization the sum of $298.63. The amount is itemized as follows:

| | |
|---|---|
| Sale of plants | $ 183.08 |
| Sale of seed | 108.20 |
| Sale of dead wood on government land, Tantalus Forest | 4.00 |
| Receipts for fumigating plants (Division of Entomology) | 3.35 |
| | $ 298.63 |

## EXPERIMENTAL WORK AT THE NURSERY.

The experimental work done at the Nursery has been along the lines of seed testing and the propagation of new and rare plants. In this connection the new testing house has been of much benefit to us. During heavy rains, outside propagation of some of the smaller seed, such as most of the Eucalypts, suffers greatly, as the seed are often washed out of the boxes and lost.

## BLUEFIELDS BANANA PLANTS.

The Bluefields banana plants, which the Board turned over to the U. S. Experiment Station in 1905 for propagation, had, by the spring of 1906, produced enough young plants to supply those who had agreed to plant and report on the same. During the month of May, Mr. Jared G. Smith turned over to this Division for shipment, plants sufficient for fifty applicants. The plants were forwarded to people in different parts of Oahu, Hawaii, Kauai and Maui.

## EXPERIMENTS WITH RUBBER.

During the month of May circular letters were sent to a number of selected persons on the different islands of the group asking them to coöperate with the Division of Forestry in making experiments in the growing of rubber trees. The circular letter stated that seed or plants would be supplied free providing they would agree to report occasionally on the growth and condition of the trees. It was proposed to make the experiments in the different districts from near sea level up to twenty-five hundred feet elevation and people were selected who had land at different elevations.

Ninety-four persons consented to coöperate with this Division and agreement postal cards stating the conditions were mailed to each to fill up. These were in due time returned to this office, filled out as required. To each applicant were sent twenty-five seeds of Ceara rubber *(Manihot glaziovii)*, filed and ready to plant, with instructions on the propagating and planting of same. The following is the number, by Islands, of persons who agreed to coöperate: Oahu, 20; Hawaii, 39; Maui, 17; Kauai, 10, and Molokai, 8. Favorable reports have already been received from a number of those who received seed. By these experiments it is believed that in time valuable data will be obtained showing the locations where this class of rubber may be successfully grown.

Four thousand seeds of the Central American Rubber *(Castilla lactiflua)* were received from Ceylon, being ordered through Mr. Jared G. Smith of the U. S. Experiment Station. A large percentage of the seed was useless when it arrived. From this consignment two hundred and forty-six plants were successfully

propagated and are doing well. The 4,000 seed cost $68.32, and customs duties of $20.50, making a total of $88.82.

On August 6, the Nahiku Rubber Company received a consignment of Para Rubber *(Hevea brasiliensis)* stumps from Ceylon, but owing to the very bad condition of the plants on their arrival at Honolulu, the company concluded not to accept them. Consequently the plants were offered for sale on August 15 by the Custom House officials. Mr. Alexander Craw bought the plants for the Board and turned them over to the Nursery. The plants were planted in boxes and in a short time a number of them started to sprout. Eighty have already been potted off and are doing well. From twenty to thirty more show signs of life and we are in hopes of being able to save them.

Three consignments of seed of the Central American Rubber *(Castilla lactiflua)*, ordered from Mexico by Mr. G. R. Ewart were handed to us to be propagated for him.

Out of the first and last consignments only about one dozen of the seeds sprouted. Out of the second consignment 238 sprouted and those are doing well.

The total number of Castilla plants at the Nursery belonging to Mr. Ewart is 250; these we have been asked to distribute for him to the different sugar plantations on the Islands.

The rubber trees planted during 1905 in the Huluamanu gulch, at Moanalua, of which mention was made in the last annual report, are doing well. These trees may in time be looked to for both seed and cuttings.

NURSERY GROUNDS.

The nursery grounds have been kept in order by one regular laborer, with the assistance of two prisoners kindly granted by Sheriff Henry.

Among the improvements made during the year may be mentioned the making of a new driveway from King street to the stables, running along the east side of the office building. The drive has been graded and macadamized with coral rock. Considerable leveling and filling up with the same material has also been done around the stables. A new seed room has been created by enclosing one end of the wagon shed. All the out houses have been treated to a coat of green stain. An Hibiscus hedge has been

planted on the division line between the Hotel Melrose and the Nursery grounds; the same is growing nicely and is from four to six feet high. Other general improvements have been the fixing up of side-walks and the leveling and grassing over of parts of the grounds that required attention.

## ADVICE AND ASSISTANCE.

This work has taken up much of the writer's time during the past year.

In accordance with the offer made in Circular No. 1 of the Division of Forestry, applications for advice and assistance have been received from a number of people on the islands of Oahu, Hawaii and Maui. In answer thereto three trips have been made to Hawaii. two to Maui and three to places on Oahu, outside of the District of Honolulu. Twenty places have been visited in and around the city in answer to applications for advice and assistance in a number of matters connected with the growing and care of plants.

The following is a list of the places visited and the nature of the advice and assistance given to those outside of the District of Honolulu.

### HAWAII.

#### *Paauhau Plantation.*

The making of a working plan for 65 acres of forest consisting principally of Blue Gum *(Eucalyptus globulus)* planted sixteen years ago. The plan was made on the basis of a twenty years' rotation crop, with a diagram showing the method of thinning recommended. Advice on a tract of land along the beach containing about 50 acres was also given. The object of planting trees on this tract was principally to protect the sugar cane from the heavy winds and salt spray; also for the wood. Ironwood *(Casuarina equisetifolia)* was recommended for this tract, the same to be planted six by six feet each way.

#### *Parker Ranch.*

An examination of the tree planting done by the Parker Ranch Company, with suggestions on the ground.

*Honomu Plantation.*

Examination and advice on patches of land along the gulches and a strip of land along the sea beach. For the patches along the gulches, Black Wattle *(Acacia decurrens)* was recommended, the same to be planted eight by eight feet each way. For the strip along the beach Ironwood *(Casuarina equisetifolia)*, the same to be planted six by six feet each way.

*Pepeekeo Plantation.*

Examination with advice on certain lands belonging to the Pepeekeo Plantation Company. The following lands were examined: A strip of land along the sea beach, patches along the gulches, also a strip of land along the top of the cane fields.

For the land along the sea beach, Ironwood *(Casuarina equisetifolia)* was recommended, the same to be planted six by six feet each way. The patches along the gulches, Black Wattle *(Acacia decurrens)* to be planted eight by eight feet each way. For the strip of land along the top of the cane lands, Eucalyptus, preferably *E. citriodora, E. globulus* and *E. robusta,* to be planted six by six feet each way.

*Wainaku Plantation.*

Examination and report on a tract of land belonging to the Hilo Sugar Company and known as Punahoa first and second.

For this tract the planting of the Black Wattle *(Acacia decurrens)* was recommended, the same to be planted eight by eight feet each way. The land is admirably adapted for such purpose.

*Pahala Plantation.*

Examination with report and recommendations on the reforesting of certain lands belonging to the Hawaiian Agricultural Company at Pahala.

Examination of lands along the following gulches: Charley Wall gulch, Hionamoana, Clover and Whitney gulches, also a strip of land between the top of the cane land and the forest reserve boundary. For the gulches, the Black Wattle *(Acacia decurrens)* to be planted eight by eight feet each way. For the strip of land

between the top of the cane land and the forets reserve boundary, principally Swamp Mahogany (*Eucalyptus robusta*), Lemon gum *(Eucalyptus citriodora)* and Red Gum tree of Southwestern Australia *(Eucalyptus calophylla)*.

### *Kukaiau Plantation.*

Examination of certain government lands in the District of Hamakua, formerly leased to the Kukaiau Plantation Company, with recommendations in regard to tree planting thereon. The object of the visit to Kukaiau was for the purpose of examining and reporting on the present condition of the different tracts which the company has held under lease from the Government, also to submit some system of tree planting for the future, whereby the lands might be improved in addition to the annual revenue received by the Government should the land be again leased for grazing purposes. The following lands were examined: The part of Kaohe 2, known as "The Burned District," the tract known as the "Old Kukaiau Plantation Lease," also the Kaohe Forest Tract.

### Recommendations.

Burned District, Kaohe 2, area 1,200 acres. If again leased for grazing purposes it is recommended that a tree planting clause be added, whereby the lessee will agree to plant and care for trees to the number of not less than 40 per acre, the same to be left in a growing and healthy condition at expiration of lease.

Old Kukaiau Plantation Lease. The part of the above tract examined and reported on is from an elevation of 2,900 feet on lower boundary up to 4,500 feet elevation. This covers an area of not less than 11,000 acres and is what might be termed "second class forest and grazing land." The same agreement is recommended for this tract as for Kaohe 2. With the trees now on the tract and the addition of 40 more per acre, quite a decent forest will be in progress at the end of the lease.

Kaohe Forest Tract. The above tract has been used for grazing purposes for the past twenty-five years and the writer is of the opinion that no better use can be made of it. There are plenty of trees on the tract and they are in a healthy condition.

*Mooheau Park, Hilo.*

Examination of trees supplied by this Division and planted on the first Arbor Day, November 3, 1905, at Mooheau Park, Hilo. The writer found most of the trees in a growing and healthy condition. This park is a great addition to the city and the people of Hilo have every reason to be proud of it.

*Naalehu Plantation and Kapapala Ranch.*

While in the Kau District, although no applications had been received, Kapapala Ranch and Naalehu Plantation were visited. The visit to Naalehu was principally for the purpose of examining the trees planted by the writer some sixteen years ago. At that time a great variety of trees was experimented with. A number of them are still to be found around the manager's house and several acres above the mill, but the large majority have perished. The principal trees left are the Blue gum *(Eucalyptus globulus),* Monterey Cypress and the Chinese plum (*Eugenia* sps.). The long droughts and cattle are responsible for the destruction of the large majority of the trees planted at that time.

Kapapala Ranch. One day was profitably spent at Kapapala Ranch, Mr. and Mrs. Monsarrat are both lovers of plants and their beautiful garden contains many rare and useful species seldom found anywhere else on the Islands. A grove of Eucalyptus, principally *E. calophylla,* was examined, also the nursery where a number of varieties of young plants were found in different stages of development. These plants were from seed sent from this Division.

*Kukuihaele Plantation.*

The visit to Kukuihaele was made for the purpose of collecting information regarding trees planted by Mr. D. Forbes a number of years ago, also to obtain information regarding the uses and value of Hawaiian grown timbers, which Mr. Forbes had been experimenting with and was using for a number of purposes on the plantation.

MAUI.

*Wailuku Plantation.*

Report with recommendations on the reforesting of certain lands on the Waikapu, Wailuku and Waihee sections of the Wailuku Plantation.

An examination of the different lands was made and the following recommendations submitted for the different tracts.

Waikapu Section: For the portion under 500 feet elevation, the planting of Algaroba *(Prosopis juliflora)*, and for the portion above the 500 feet level, Swamp Mahogany *(Eucalyptus robusta)*.

Wailuku Section: The preservation of the water is the principal object for this section. The following trees are recommended: For the tops of the barren ridges, Swamp Mahogany *(Eucalyptus robusta)*, Lemon gum *(Eucalyptus citriodora)*, Blue gum *(Eucalyptus globulus)* and species of Casuarina, including *Casuarina quadrivalvis*. For the sides and sheltered places, Silk Oak (*Grevillea robusta*), Japan Cedar (*Cryptomeria japonica*), Australian Black Wood (*Acacia melanoxylon*), Koa (*Acacia koa*) and a few others.

Waihee Beach Tract: The Ironwood *(Casuarina equisetifolia)* is recommended for this tract, but the Hala *(Pandanus odoratissima)*, Milo *(Thespesia populnea)*, Kamani *(Calophyllum inophyllum)* and *Barringtonia speciosa* might also be grown successfully. A line of each along the sea shore is recommended.

*Polipoli Water Reservation, Kula.*

This tract of land is 673 acres in extent and lies between the elevations of 5,000 feet and 6,250 feet above sea level. The object of reforesting this tract is to protect and, if possible, to increase the water supply of Polipoli and other smaller springs. It is essential that fast growing trees be planted for the first crop so that a water shed may be established as soon as possible. Swamp Mahogany *(Eucalyptus robusta)* is recommended as the predominating tree, but a few Lemon gum *(E. citriodora)*, Red Gum *(Eucalyptus rostrata)*. The Red gum of Southwestern Australia *(Eucalyptus calophylla)* might also be planted, the spacing to be six by six feet each way.

*Wailuku Improvement Association.*

At Wailuku the trees planted by the Wailuku Improvement Association, at the instance of the Hon. W. J. Coelho, were examined. The writer was very much pleased to see that the trees which had been sent from the Government Nursery from time to time had been made such good use of. Much praise is due Mr. Coelho and other members of the Association for the great interest they are taking in beautifying their streets and highways.

*Lahainaluna School.*

Examination of the grounds and certain lands belonging to the Lahainaluna school, with report and recommendations in regard to tree planting, etc. The following tracts were examined and reported on: The grounds, area about eight or nine acres, upon which the school buildings, dormitories, principal's house and work shop, etc., are erected; a piece of land within the grounds and to the north of the main school buildings; also the mountain tract, an area of about 1,000 acres. The lower end of this tract commences at an elevation of about 700 feet tbove sea level and runs up to the top of the mountain.

Recommendations.

School Grounds: Several suggestions were made verbally to Mr. C. A. MacDonald and Mr. C. Flack in regard to the planting and laying out of the grounds. These will be acted on as soon as time and plants are available.

Land to the North of the School Buildings. The piece of land is about one and a half acres in extent and is suitable for the growing of citrus and other fruits. A windbreak consisting of three rows of Black Wattle (*Acacia decurrens*) to be planted six by six feet each way to run along the north and east side should be the first work; then the planting of lime trees, the same to be planted twenty-five by twenty-five feet each way.

Mountain Tract: For the mountain tract the following trees are recommended: For the land under 1,500 feet elevation Black Wattle (*Acacia decurrens*), to be planted eight by eight feet each way; above 1,500 foot level and up to the top of the mountain,

*Eucalyptus robusta, Eucalyptus citriodora, Eucalyptus calophylla, Acacia melanoxylon* and *Cupressus macrocarpa* for the most exposed places. For the more sheltered places *Cryptomeria japonica, Grevillea robusta* and *Acacia koa.*

### *Haiku Ranch.*

At Haiku Ranch the trees planted by the company a number of years ago were examined. A great deal of tree planting has been done on this ranch with excellent success. Mr. David Fleming, the present manager, is very much interested in the forestry movement and contemplates planting large numbers of the best timber trees in the near future.

## OAHU.

### *Honouliuli Ranch.*

Examination of the trees planted by the ranch company with advice on the selection and planting of trees for the future. The Honouliuli Ranch Company, by its manager, Mr. H. M. von Holt, has done a great deal during the past few years towards the preservation and extension of the forest area. Large tracts of land along the tops of the gulches have been fenced off and the cattle driven out, with the result that the growth of a large number of young koas and other indigenous trees has been encouraged. A large number of different kinds of exotic trees has also been planted on this ranch during the last few years with good success. This work deserves the highest praise, for very seldom indeed do we find trees planted and cared for in the manner that they are to be found on this ranch.

### *Waianae-kai Forest Reserve.*

Report with recommendations on the reforesting of the tract of land known as the "Waianae-kai Forest Reserve." This tract takes in all of the upper part of the Waianae Valley and has an area of 3,257 acres, more or less. The tract is mostly government land, the greater part of which is covered with indigenous trees and other vegetation. This is the water shed for the Waianae Company, who control all the land in this valley makai of the

reserve. Most of the land owned by the company is planted in sugar cane. With the permission of the Board of Agriculture and Forestry, it is the desire of the Waianae Plantation Company to commence immediately to drive out all the cattle and fence the tract. The starting of a nursery and the planting out of forest trees on this reserve will also be undertaken by the company.

Recommendations.

For the part of the reserve under 600 feet elevation above sea level, the planting of Algaroba *(Prosopis juliflora)* is recommended. For the part of the reserve above the 600 foot level, a variety of trees is recommended as follows:

For the tops of the ridges and other exposed places: *Eucalyptus citriodora, E. globulus, E. robusta, Acacia melanoxylon, Casuarina quadrivalvis, Cupressus macrocarpa* and probably a few others which may be selected later.

For the flat land, also the sides and bottoms of gulches, *Cryptomeria japonica, Grevillea robusta, E. robusta, E. rostrata, E. calophylla* and *Acacia koa.*

*Ii Estate Land.*

Examination with advice on the planting of trees on the land of Waipio, in the Ewa District, belonging to the John Ii Estate.

The tract of land upon which advice was asked is the top of sub-gulch to the east and close by the mountain house.

The planting of *Eucalyptus robusta* was recommended for the most exposed places. For the more sheltered places *Cupressus macrocarpa, Cryptomeria japonica, Grevillea robusta, Acacia koa, Acacia melanoxylon* and probably a few others which may be selected later.

SUMMARY.

The foregoing statement includes all the large places visited and shows the nature of the advice given to those outside of the district of Honolulu. Of the nineteen places visited planting plans or detailed letters of advice were prepared and sent in eleven cases. For the other eight suggestions were made verbally at the time of the visit.

The assistance given to those in and around the city, as previously mentioned, in most cases had to do with matters connected with the growing and care of plants. The applications for this local work were often made over the telephone or in person. In addition much information on various subjects has been given to persons who have called at the Nursery.

For further information regarding descriptions or recommendations, etc., of any or all of the places mentioned where advice and assistance was given, the writer would refer to reports, plans, etc., drawn up at the time of the visits. These are on file in the office of the Division of Forestry.

Seed has been supplied from the Government Nursery to all those for whom working plans were made. The writer takes pleasure in stating that the majority have commenced to establish nurseries and are making preparations to plant in accordance with the plans and recommendations made.

### *Press Bulletin.*

Press Bulletin No. 4 of the Division of Forestry, entitled "Instructions for Propagating and Planting Forest Trees," which was issued during the year, has been given to all requesting advice and assistance on the above subject.

### *Acknowledgment.*

Before leaving the subject of advice and assistance the writer would like to state that he was everywhere very cordially received and that every assistance was given him in the way of transportation, the pointing out of lands and all other desired information. For these and other courtesies received, the writer avails himself of this opportunity of expressing his thanks.

## REPORT OF THE DEPUTY FIRE WARDEN.

On March 22, 1906, the writer was appointed Deputy Fire Warden at Large for the Territory. During the period covered by this report several small fires have occurred in the neighborhood of Honolulu at each of which (excepting the Country Club fire) the writer was present.

On February 13, a fire was reported on Tantalus. The writer with three men from the Nursery went to where the smoke was seen and found a Japanese employed by Mr. T. Clive Davies burning several large piles of grass on the latter"s lot. The fire was watched till all danger of its spreading was over. On our way back, when near the Forester's cottage, we met a gang of men from the road department, who returned to the city on being told that the fire was out.

On the evening of March 11, a fire was observed at Palolo Valley. The writer with eleven men from the road department and one from the nursery started for it. It was found that the fire had started on lot No. 16, and it was supposed that children playing with matches was the cause. After four hours of hard work this fire was put out about 11 o'clock. The area burned over was covered with grass and brush, the fire being put out before it reached the native forest. The area burned over was, approximately, eight or nine acres.

On March 30, a fire was reported in Nuuanu Valley. The writer with four men from the Nursery on being informed by telephone started at once to investigate. On arriving at the scene, it was found that the fire was in a dwelling house belonging to Mr. W. C. Kapulani.

On the evening of July 24, at about 6 o'clock, a fire was reported in Nuuanu Valley. The writer on receiving word started at once with one of the men from the Nursery. When we arrived at the fire, which was on the east side of the valley opposite the old Queen Emma place, we found that about one acre had already been burned. With the assistance of two men, who reside near by, the fire was put out about 9 o'clock. About four acres were burned over, consisting principally of guava, lantana and long grass, with a few Hau trees. No clue could be found regarding the person who started this fire.

The writer was on Maui when the fire occurred on the Country Club lands in Nuuanu Valley.

## NUUANU FOREST STATION.

At the Nuuanu Station two men have been employed during the year, their principal work being in keeping the vine (Maile pilau)

in check, clearing grass away from the small trees and doing other routine work.

The workmen's house has been painted inside and the outside given a coat of green stain.

### CONDITION OF FOREST.

The forest is in a very healthy condition and the trees have made considerable growth during the past year. As years go by it becomes evident that the planting of trees in Nuuanu Valley is not such a great mistake as some predicted, while the operation of planting was going on. Instead of the land lying idle as it was before tree planting was started, there are now prospects of the Government realizing a revenue from it, when these trees arrive at maturity. The clothing of the slopes with trees also increases the value of the land as a watershed.

From a large number of the native trees that were threatened with being strangled by the "Maile pilau" the vines have been cleared away. There will be time for more of this kind of work during the coming year as the young trees are getting up and do not require so much attention.

## TANTALUS FOREST.

The Tantalus forest is also in a healthy and growing condition and the percentage of dead trees has been less than for the past several years. Four cords of dead wood were taken from the forest during the year, the price received for the same being one dollar per cord on the stump. The fruit and other valuable exotic trees planted a number of years ago and mentioned in my last report have been kept clear of brush and vines.

On March 6 the Board authorized the employment of a Forest Ranger for the Tantalus Heights section, District of Kona, Island of Oahu, at a salary of $60.00 a month. David Kapihe was appointed to the position and has done excellent work. His principal work is to see that the forest fire laws are observed and to be on hand when people have brush or other material to burn. He has also done considerable work in clearing out trails when he was not engaged looking after brush fires.

Respectfully submitted,

DAVID HAUGHS,
Forest Nurseryman.

## Reports of District Foresters.

Following the usage of former years the Superintendent of Forestry requested the several District Foresters to submit reports to be included in this publication. The replies received are given below:

LETTER FROM THE SUPERINTENDENT OF FORESTRY.

Honolulu, Oahu, November 22, 1906.

Dear Sir:—The law creating the Board of Agriculture and Forestry makes mandatory the preparation and publication of an annual report. Following the established custom I wish to include in the Report of the Division of Forestry for the calendar year 1906 a statement from each of the District Foresters dealing with one or all of the following subjects:

*Present Extent of the Native Forest:* A concise description of the present limits of the native forest in your district, for the purpose of comparison in future years.

*Present Condition of the Forest:* Notes on the present condition of the forest and injuries from any cause during the past year.

*Private Forest Reserves:* Have areas of privately owned forest land been set apart in your district as private forest reserves? Notes on the ownership, area, length of time reserved, whether or not the area is fenced, and remarks on the object and benefits of the reserve, are in order.

*Tax Exemption of Forest Land:* Under the law forest land that is fenced off and treated as a reserve may be exempted from taxation. Has this provision been taken advantage of in your district? If so, for what area and since when? Does the law work well in practice? If not, why?

*Forest Planting:* During the year considerable interest has been manifested in forest planting. Notes as to the area, kind and number of trees planted, type of plantation established, etc., in your district are in order.

*Forestry in General:* Notes of interest on any forest matters.

As it is desired to have the report ready for distribution early in February, contributions should be in my hands not later than Christmas week.

Very sincerely yours,

RALPH S. HOSMER,

Superintendent of Forestry.

REPORT OF MR. A. S. WILCOX.

*Halelea, Kauai.*

Lihue, Kauai, Nov. 30, 1906.

Dear Sir:—Your favor of 22nd instant is at hand, and has had my careful consideration. I regret exceedingly that I am not in possession of sufficient information to make an exhaustive report.

*Present Extent of the Native Forest:* So far as I am aware, no accurate survey has been made of the District, and guesses would not be of any particular value.

*Present Condition of the Forest:* The present condition of the forest is excellent. There have been no forest fires, nor any damage by cattle worth mentioning.

*Private Forest Reserves:* Practically half of the land of Kalihiwai has been a Private Forest Reserve for a great many years. The growth is very dense, and this fact in connection with other conditions has rendered fencing unnecessary. The area I should estimate roughly at four thousand acres. The land is owned by myself, and it is my present intention to protect the forest as much as possible, to conserve the water supply.

*Tax Exemption of Forest Land:* No advantage has been taken of this provision, consequently I am unable to say whether the law would work well in practice or not.

*Forest Planting:* Nothing has been done in this line, as it has not been considered necessary. The district is very sparsely settled, and there is very little demand for firewood, which can easily be obtained without going to the mountains; the absence of fires, the small number of cattle, confined mainly to the makai lands

on account of the impenetrable mass of undergrowth in the woods, the abundant rainfall, all tend to make planting scarcely worthy of consideration.

Yours very truly,

A. S. WILCOX.

REPORT OF MR. F. SCOTT.

*Koolau, Kauai.*

Kilauea, Kauai, H. T., Dec. 28, 1906.

Dear Sir:—Your letter of the 22nd ultimo, re Report of the Division of Forestry, to hand and in reply to your various subjects would state as follows:

*Present Extent of the Native Forest:* I am not able to give the limits of the native forest as there are no defined lines at present.

*Present Condition of the Forest:* The forest is in good condition and there have been no injuries from any cause during the past year, as I have driven out all cattle from the forest.

*Forest Planting:* There has been no planting done for the past year.

Respectfully yours,

F. SCOTT.

REPORT OF REV. J. M. LYDGATE.

*East Kona, Kauai.*

Lihue, Kauai, Dec. 28, 1906.

Dear Sir:—In response to your request I beg to hand you the following notes in regard to forest in my District of Koloa.

*Present Extent of Native Forest:* This is practically all contained within the bounds, surveys of which are now being prepared for you. This is a part of the Waialeale Range of Mountains. The Haupu Range retains little or no forest, what there is being of a scrubby and unimportant character. This region, however, in my opinion, ought to be set apart as a reserve and might

support an interesting and valuable forest growth, the more so as it is easily accessible.

*Condition of Forest:* Except on the outskirts where the forest is exposed to destructive influences, it is, so far as my observations go, in a healthy and normal condition. There have been no fires or other devastating injuries during the year in this district.

*Private Forest Reserves:* Practically all the forest land in my district, as you know, is privately owned, controlled by the two sugar estates—the Koloa Plantation and the McBryde Sugar Co. The McBryde area, about two-thirds of the whole, has already been substantially fenced and arrangements are being made to fence the Koloa Plantation area.

*Tax Exemption:* Advantage has not been taken of this provision. I fancy for the reason that the amount of the tax remitted would be trifling and would cut no figure in the taxes of a large estate which, in any case, is taxed on a valuation as a whole.

*In General:* Whatever may be thought of lantana as a competitor and possibly a destructive agent for the forest, my observation has led me to believe that it is a valuable agent on the outskirts of the forest where its dense growth protects and perhaps rallies the retreating line of the forest, and in such regions it, to a considerable extent, serves the beneficial purposes of the original forest.

I had occasion recently to inspect a burned over sub-forest area at Wainiha and was pleased to note a generous and healthy young growth of Koa and Sandalwood coming up, so that under favorable conditions there will probably be a better forest showing there than before the fire. The dense coating of undergrowth had not given the forest a chance.

In conclusion I can only add my emphatic conviction that the forest areas should all be fenced as soon as possible.

Respectfully yours,

J. M. LYDGATE.

## REPORT OF MR. WALTER D. McBRYDE.

*East Kona, Kauai.*

Brydeswood, Kauai, Dec. 5, 1906.

Sir:—I beg to acknowledge yours of Nov. 22, relative to a report on the forest conditions and forest work accomplished in this district.

*Forest Reserve:* The private forest reserves fenced off with a strong five-wire fence, all cattle excluded, set aside by the McBryde Sugar Company, as also the government forest reserve of Kalaheo, are showing marked effects from the exclusion of the cattle; the uluhi fern, as also other ferns, are growing rapidly over trails and covering bare spots, and young maile is growing abundantly where two years ago hardly any was to be found. I do not notice as yet, the growth of any young trees, but this is hardly expected in the short time the fence has been completed. It would, I think, be advisable to plant out within the forest reserve such foreign trees as the *Grevillea robusta* and the Eucalyptus, for these are known to reseed themselves on the slopes of Haleakala as also in other forests on this island.

*Fires*: Fortunately, I am able to report no forest fires within the last exceptionally dry year.

*Tree Planting:* The McBryde Sugar Company have done a great deal of tree planting during the year, putting out thousands of trees along their cane fields in the line of windbreaks and also planting in the gullies for the purpose of future firewood and posts.

The Koloa Sugar Company are also actively engaged in the reforesting of their lands denuded of forests through fire and the depredations of cattle. The work now being undertaken will speak for itself in a few years.

Within the past three years I have, with the aid of the McBryde family, entered enthusiastically into the reforesting of the lands adjoining the homestead and have, within that period, put out thirty thousand trees. Of this number I should say, fully 10 per cent. are fruit trees, viz.: mangoes, pears, oranges, peaches, etc.

I am more than pleased with the growth of the different Eucalypts which I have set out. I am now experimenting with some thirty varieties.

I am glad to report that I have been able to furnish free, from my nursery, to settlers and others some thousands of young trees of different varieties.

Very respectfully,

W. D. McBryde.

REPORT OF MR. FRANCIS GAY.

*West Kona, Kauai.*

Makaweli, Kauai, Dec. 3rd, 1906.

Sir:—In reply to yours of the 22nd ult. I beg to report as follows:

*Present Extent of the Native Forest:* Has not been surveyed, but is all covered with native woods.

*Present Condition of the Forest:* In good condition.

*Private Forest Reserves:* Gay & Robinson have for many years past set apart all their mountain lands and wherever necessary fenced.

*Tax Exemption of Forest Land:* Gay & Robinson have never claimed exemption.

*Forest Planting:* It has not been necessary to plant the mountain lands, but on the low lands, forests were started by the land owners in the district, mostly by V. Knudsen and Gay & Robinson.

*Forestry in General:* No forest fires occurred this year, but small grass fires, that didn't do much harm.

Yours very truly,

Francis Gay.

## REPORT OF MR. AUGUSTUS F. KNUDSEN.

*Napali, Kauai.*

Kekaha, Kauai, Dec. 7, 1906.

This section consists of that part of the Waimea District lying west and north of the Waimea and Poomau canons and the district of Napali.

All the upland is well forested, while the cliffs and sides of the canons have been stripped of all verdure by the goats.

The whole of the Mana and Kekaha water shed is a semi-arid region. More or less compact clumps of trees or groves exist at the heads of the Mana gulches. These are Koa on the ridges and mostly Kukui in the gulches. There are also several groves of Lehua, some of them very fine though of small area. None of these exceed one acre in extent, but follow in frequent succession a belt of country from one to two miles wide between the 2000 and the 3000 foot contour line. This extends from the escarpment of the Waimea pali on the south to the Kauhau gulch on the north. This is the boundary of the private forest reserve. Within the forest reserve is an almost continuous forest; the only denudation is along the pali where the wild goats are doing and have done a great deal of damage. From the Kauhau gulch to Kalalau there is hardly a tree left on the bluffs. From the south buttress of Kalalau, called Nianiau, northwards the goats are making slower progress on account of the greater monthly precipitation. But gradually the forest is receding, the turf and soil is being trampled and washed off, and the bare rock remains grim and forbidding.

*Present Condition:* South of the forest boundary fence running from Kauhau pali to Puu Hinahina is grazing land and naturally there is no new or young growth, but this is outside of any forest in its true sense, and is a dry section in which no rivers originate. Within the reserve the forest has grown more dense and has not suffered any injury except as far as the goats are concerned.

*Private Forest Reserves:* The Knudsen Estate protected the high upland forest by continual and relentless hunting of the wild

cattle and goats as early as 1882. By 1890 the wild cattle were practically extinct, not only on the lands controlled by the Estate, but on the adjacent parts of Napali. In 1898 the firm of Knudsen Bros. built a fence at a convenient location to prevent their cattle from encroaching on the great forest. This is the fence mentioned above and protects an immense area variously estimated at from eighteen to thirty thousand acres. This forest covers the headwaters of the Milolii, Nuulolo, Awaapuhi rivers and parts of the drainage areas of Kalalau and Waimea rivers.

*Tax Exemption:* No advantage has been taken so far of this provision in the law relating to forest reserves.

*Forest Planting:* Nothing of any great extent has been attempted in this section. Mr. A. F. Knudsen has made sundry attempts with many varieties to find a forest tree easy of propagation that would not need care or irrigation. So far *Acacia melanoxylon,* the Australian Koa, has been the most satisfactory. The seed was planted in open spaces in the forest, amid grass and bracken, by merely scratching the ground every few feet and putting in the seed. There is now quite a stand of trees two to six feet tall, at practically no expense. Some will grow even if the seed is merely broadcast on the ground. A New Zealand tree known as the Karaka has begun to spread voluntarily from two original trees planted at Halemanu by Mr. V. Knudsen about 1880. This spreading has been assisted by carrying the seed and scattering them far and wide. It makes an excellent secondary growth and makes a dense shade. Cattle eat the leaves with avidity. Of late years the most marked forest growth has been seen in the great number of Kauila (Ironwood) trees springing up in all directions within the fenced area, and the seedling Koa trees starting up as soon as the dying parent tree drops its leaves, thus letting in the sunshine to start the waiting germ into life. These two trees promise to regenerate the forests in the vicinity of Halemanu.

*Forest Fires:* One forest fire occurred within the forest area during the year. It occurred about August 12th, and burned over an area of about four acres. It was open grass and fern country with a few scattered trees. The fire originated in a burning stump that was thought to have been carefully extinguished.

No loss was sustained. Back firing from roads and trails to leeward and beating on the windward side quickly extinguished it. Six men from neighboring camps, with several women and children, put the fire out with no expense financially.

AUGUSTUS F. KNUDSEN.

## REPORT OF MR. JOHN HERD.

### *Koolaupoko, Oahu.*

Maunawili Ranch, Waimanalo, Oahu, Dec. 24, 1906.

Dear Sir:—In compliance with your request, I herewith submit my annual report on forest conditions:

*Present Extent of Native Forest:* The forest in this section is confined to a very narrow strip, running along the base of a portion of the Koolau Mountain Range. As the mountain wall rises very abruptly, the strip referred to varies considerably in width and is much interrupted by the numerous gulches and ravines running through the same.

*Present Condition:* The limited and interrupted area of forest above noted is mostly made up of Kukui and Ohia with occasional Koa trees, and its condition has not changed very materially since my last report was submitted. It has been noticeable, however, that many of the Ohia ai (Mountain Apple) trees in the gulches continue producing much dead growth from the top of tree and that the Koa twig and seed worms are still in evidence.

*Re-Forestation:* W. G. Irwin, the owner of all the area within the confines of the Maunawili Ranch, is the only person who has so far gone to any trouble or expense in either protecting or reforesting the section under my control as District Forester. On the Maunawili Ranch, Mr. Irwin has established and planted eight (8) separate and permanent reserves consisting of about 300 acres. These reserves are all fenced in, the object being to protect the adjoining native forest above referred to.

*Number and Variety of Trees Planted:* During the past year, there have been planted out on the ranch above named 3,133 trees of the following varieties: Alligator pear, mango, kamani, milo,

koa, *Albizzia moluccana, Grevillea robusta,* mahogany, jacaranda, mammea apple, traveller's tree, bouganvillea, banyan, longan, *Castilloa elastica, Manihot glaziovii,* cocoanut, magnolia, cryptomeria, araucaria and Bluefield bananas.

*Forestry in General:* The past season was an exceptionally dry one, which fact prevented the planting out of any large number of trees. Advantage of the dry weather was taken, however, by clearing around trees of former plantings.

Respectfully submitted,

JOHN HERD,
District Forester.

## REPORT OF MR. A. M. NOWELL.

*Waialua, Oahu.*

Wahiawa, Oahu, Dec. 27, 1906.

Dear Sir:—I am in receipt of your letter of November 22nd, asking for my contribution to the annual report of the Board of Agriculture and Forestry, for the year 1906, the same to be dealt with on the following lines:

*Present Extent of the Native Forest:* A concise description of the present limits of the native forest in this district would necessitate more of a study than I have up to this time been able to give the matter, but it is with certainty that I can say that since the cattle have been excluded from the lower forest, the latter has been increasing steadily and surely.

*Present Condition of the Forest:* This forest is at present suffering but little from injuries of any kind, and is in a rather better condition now than at the same time last year, and this in spite of the fact that the twelve months just past, with the exception of the present month of December, have been very dry.

*Private Forest Reserves:* There has been, as yet, no area actually set apart in this district, as a Forest Reserve.

A reserve, of approximately 23,040 acres, has, however, been proposed, and considerable preliminary work done on the proposition, but the project is still pending.

*Tax Exemption of Forest Land:* There is an area of about 12,700 acres of Upper Kawailoa and Paalaa, that has been fenced off for a number of years, and practically treated as a Reserve, but I believe there has been no tax exemption on this land.

*Forest Planting:* There has been nothing done in this line here this year, but negotiations are under way with the manager of the Waialua Agricultural Co., Ltd., for the reforestation of certain lands of Kawailoa and Paalaa, between the elevations of 800 and 1,200 feet.

I believe this matter should be pushed, as the successful fulfillment of such an undertaking, would, in my opinion, be most beneficial in its results. There would be an increase in precipitation, which would be of distinct benefit to the whole district, and there would be a source of profit to the parties concerned.

*Forest Fires:* There have been but two fires in this district this year, and neither of these could be termed a *forest fire.*

On the third of March there occurred a grass fire, which, though put out before any damage was done, came very near to being a very disastrous one.

This was at Wahiawa, on the north side of the north fork of the Kaukonahua, and directly opposite to the scene of the disastrous fire of March, 1905, which, by the way, might lead one to suppose that both *March* and *Wahiawa* were synonymous with *fire.*

This fire burned about twenty-five acres of grass land, but in several places reached as far as the top of the Kaukonahua gulch, and succeeded in spreading down into the gulch, where it was with difficulty gotten under control before reaching the timber.

The mauka line of the burned area was less than two miles from the makai line of the heavy forest, and, with the tall rank grass as dry as it was at that time, had the fire obtained a trifle more start, the consequences might have been very severe.

This fire was put out by Waialua Agricultural Co. men, a luna and three Japanese laborers, who live near by. They responded promptly, and did their work thoroughly as well as rapidly, and had the fire out when I arrived.

This fire satisfied me conclusively that I should avail myself of the suggestion in your letter of February 23rd, to cause the

issuance, under the Forest Fire Law (Act 71, Session Laws of 1905,) of a *Special Fire Warning.* I recommended that the area, bounded as follows, be thus guarded:

*South*—Waianae District line.

*South and West*—The Kaukonahua stream.

*West and North*—The Waialua Agricultural Co.'s ditch, from the Wahiawa Dam, and an extension of same, following approximately the 700-foot contour, to the Waimea boundary.

*North and East*—The Waialua-Koolauloa District line.

This recommendation was approved, and the area described became the object of a Special Fire Warning, for a period of six months from March 7th, 1906.

I would say that during this period I was not called upon to issue a single permit for starting fires, but I have not the least doubt that, had there been no warning during that dry time, I should have had numerous fires to deal with. This, to my mind, goes to show that the customary fires, occurring during dry weather, are not necessary ones or ones that could have taken place legitimately by the application for a permit, but were fires that start through the carelessness and neglect of cattle men, hunters, and very possibly charcoal-burners.

The second and last fire this year, occurred on August 2nd, also at Wahiawa, and on the same ridge as the above mentioned one, only a little further makai.

About two acres of grass land was burned, the fire being put out by the same men that put out fire No. 1, and no damage was done.

*Rainfall:* It may be interesting to follow the record of rainfall, that I started in my last year's report, so I shall repeat, adding the new record for this year. The following figures are for an elevation of thirty feet:

| | | | |
|---|---|---|---|
| 1901.....35 | inches. | 1904.....66 | inches. |
| 1902.....27 | " | 1905.....18 | " |
| 1903.....16 | " | 1906.....27 | " |

This makes an average annual fall of 32 inches. As stated last year, the rainfall five miles inland, at an elevation of 1,000 feet,

is double that at thirty feet, while the fall ten miles inland is approximately four times that at 30 feet.

In conclusion, I would sav that I hope the year 1907 will see the establishment of the Waialua Forest Reserve, the accomplishment of the reforestation work as outlined, and the fulfillment of any other plans for forest work that may be for the benefit of the district.

Respectfully submitted,

A. M. NOWELL,
District Forester, Waialua District.

REPORT OF MR. JAMES MUNRO.

*Molokai.*

Kaunakakai, Molokai, Dec. 7th, 1906.

Dear Sir:—Yours of 22nd ult. to hand and contents noted. For most of the data required I will have to refer you to Mr. Chas. A. Hartwell.

In re amount of tree planting done up to date this is all I can fine record of: 12,450 Black Wattle (there must be very much more); 5,695 *Eucalyptus robusta* (more to plant); 3,655 White Locust (approximately; more to plant); 2,000 Japanese Sugi (approximately).

I will try and get some more data together on the amount of tree planting done and furnish you with it later.

No forest fires during the year.

Very truly,

JAMES MUNRO.

REPORT OF MR. C. C. CONRADT.

*East Molokai.*

Pukoo, Molokai, Dec. 8th, 1906.

Dear Sir:—In reply to yours of November 22nd, asking for a report on forestry for the east end of the island of Molokai, I

have to state that owing to the fact of my being a resident here of only a few months, I have not had the chance, nor time, to cover the ground from which to gather my information, as to the present extent of the native forest and present condition of the forest.

As to private forest reserves I know of none, although parties are contemplating the setting aside and also fencing for private forest reserves. As to forest planting I do not know of any one that has undertaken that in this district.

Respectfully yours,

C. C. CONRADT.

REPORT OF MR. L. BARKHAUSEN.

*Lahaina, Maui.*

Lahaina, Dec. 26th, 1906.

Dear Sir:—Your favor of the 22nd ult. to hand and contents noted. I am unable to give you the area of native forest land in this district. The forest land under control of the Pioneer Mill Co., Ltd., in an altitude from 2000 feet and higher has been fenced in for a number of years, and as far as I have been able to observe the forest is in a healthy condition.

The company has never yet taken advantage of the tax exemption clause for the simple reason that it did not know of the existence of such clause. There have been no forest fires in the district during the year.

Yours very respectfully,

L. BARKHAUSEN.

REPORT OF MR. C. B. WELLS.

*Wailuku, Maui.*

Wailuku, Maui, H. T., Dec. 19, 1906.

Dear Sir:—Your esteemed favor of Nov. 22nd to hand and I must apologize for not answering sooner.

*Present Extent of Native Forest:* I am unable to give. I have been waiting for some two years to go over the whole ground with you.

*Present Condition of Forest:* As far as I have been able to observe, it is in the same condition as last year.

*Private Forest Reserves:* There are none.

*Forest Planting:* None has been done. The Wailuku Sugar Company are planning to commence tree planting on quite a large scale and are only delayed by not having a competent man to attend to planting of seeds and looking after the trees when set out.

I regret I cannot give you a more satisfactory report and will again write you asking you to visit me at Wailuku and go over the ground with me. I am

Very truly yours,

C. B. WELLS,
Forester for District of Wailuku, Island of Maui.

REPORT OF DR. J. H. RAYMOND.

*Kula, Honuaula and Kahikinui, Maui.*

Wailuku, Maui, Dec. 8, 1905.

Dear Sir:—I herewith submit a brief report on the conditions appertaining to the forest in my district:

The forest belt in the District of Kula extends from an elevation of from approximately 3,000 feet to the top of the mountain, the thickest portion being at an elevation of about from 3,500 to 5,000 feet.

The lands from north to south along the slopes of Haleakala are as follows: Waiakoa, Kaonoulu, Waiohuli, Keokea, Kamaole and Ulupalakua. The mountain slopes from approximately 7,000 feet to about 4,000 feet, which would be the highest point above Ulupalakua. The forest, or what is left of a once densely covered land, is composed of straggling, dead and rapidly dying mamanis, ohias, koas and a variety of other native trees usually found on the mountain slopes. There still remain quite a number of healthy

trees throughout the district above referred to, but unless something is done at once to protect them, within a comparatively short time, what are left will be destroyed.

The lands of Waiohuli and Keokea are under lease to the Cornwell Estate; said lease expires in 1911. The lands of Kamaole and Waiakea are government lands, the latter, the upper part of which constitutes in part the Polipoli Reservation, is at this time a forest reservation, containing 673 acres, and is maintained under an agreement with the Hawaiian Government by the Raymond Ranch as a forest reserve. This land is to be planted with a variety of trees, the seed of which have been furnished by the Department of Agriculture and Forestry of the Territory, and within a few weeks will be planted. It is proposed to plant principally the different variety of eucalyptus, on recommendation of Mr. David Haughs of the department. The desolated appearance of the lands above referred to, Waiakoa, Waiohuli and Keokea in particular, presents in itself the strongest argument in favor of action on the part of those interested toward saving to the island what was once and may be again a rich agricultural district. Immediately below these lands there are several hundred acres of agricultural land rented out to Chinese corn-planters. These lands for forty years have been very productive, it being said that that district, during the time of the visitation of the whaling vessels to these islands, furnished them with produce, most particularly Irish potatoes, and derived therefrom a good revenue.

It is now no longer necessary to dilate upon the advantages of the conservation of forests in that region, nor is it at all necessary to point out to you the advantages to the interests of the Territory at large of these agricultural lands; suffice to say that there are hundred of acres of choice Government land, both above and below the government road, that will support a large number of bona fide American settlers, and the writer believes everything should be done toward protecting the forest for the above reason. The lands above and below the corn-fields are used by the Cornwell Estate for pasturing cattle, and it is due to this that the forests have been destroyed.

The lands adjoining Kamaole, extending to the east, around to

and including the southern part of the island are as follows: Ulupalakua, Kanaio, Auwahi and Kahikinui. All through Ulupalakua there are to be found a variety of beautiful, large eucalyptus trees, pines, wattles and many other varieties that were planted by the late Captain Makee. A more fitting and lasting monument could not possibly have been erected by him to commemorate his industry and unselfishness and desire to benefit those who were to follow him than the planting of this magnificent collection of trees. That they have had the desired effect upon the precipitation of moisture there can be no doubt, as ample proof is at hand of the great benefit in this respect, derived therefrom. While no definite plans have been made toward reserving any particular land at Ulupalakua for the purpose of planting trees, it is our intention to do much in this respect, more especially toward planting of fruit trees.

The land of Kanaio is in part owned by the Government and the Raymond Ranch, besides a large number of kuleanas. The upper part of the middle third is quite densely covered with mostly native shrubs and a number of native trees. It is at present not under lease.

The land of Auwahi extends on the southern slopes of Haleakala from the top of the mountain to the sea and is owned in fee simple by the Raymond Ranch. Upon the upper third of this land can be found a very well preserved forest of native trees; the greater portion of this area of forest land has been fenced off and is now maintained as a private forest reserve by the owners, approximately 1,200 acres. This land has been fenced and there are practically no cattle within the reserve.

The land of Kahikinui, also on the southern slopes of Haleakala running from the top of the mountain to the sea, contains about 25,000 acres and between the elevation of 3,000 feet and the top of the mountain can be seen the remnants of a once densely wooded land, more particularly the lower part of the upper third. The forest stretching across the entire slope of the mountain has been destroyed by the cattle and it is commonly known and referred to by the natives now living in that district. The forest consisted at one time, mostly of Mamane and Ohia trees and in various places there are to be found at this time a number of

Ohia trees scattered throughout the district, which, in some instances, have been fenced off by the Raymond Ranch.

In 1901, when I purchased the interest of Kahikinui, there were about 3,000 head of cattle running on that land and Auwahi, mostly on Kahikinui, the greater number of which were to be found on the upper third of these lands and were mostly wild. It was plainly seen that the best part of the entire ranch was in this particular region. Necessity compelled the fencing off of nearly one-half of the land in order that the wild cattle might be controlled, and accordingly I constructed, at my own expense, a five-wire fence extending across the entire slope of the mountain, running through the lower part of what was once the thickest part of the forest, and upon completion of said fence and since that time we have continually reduced the number of cattle on top of the mountain and I now observe the following effect. There has been a rapid growth of all of the native shrubs above the fence line and I note most particularly that from the fence line to the very top of the mountain there has been a rapid growth of young Mamani trees and from the manner in which these shrubs and trees have grown it would seem that it will be but a comparatively short time when the forest in that region will again be in evidence. The ill effect upon the Kahikinui lands, from loss of forests, as well as upon the adjoining land of Waiopai, controlled by the Haleakala Ranch Co., to the east of the Kahikinui lands, has been felt most particularly during our incumbency and is well known by every one who is familiar and has been familiar with those lands for many years past.

The most striking evidence of the effect of the conservation of forests can be noted in the difference of pasture lands between the Waiopai and Kahikinui lands and that of Auwahi, the land referred to as having its middle third reserved for forest purposes. During the past three years when the lands of Waiopai and Kahikinui were suffering from the most severe drought known in their history, Auwahi supported a large number of cattle and was visited by frequent showers, which the writer attributes solely to the influence of the forest growth.

From my experience with lands of Kahikinui during the past

four years and considering the effect upon the productive capacity of the land for pastural purposes (admittedly the only use that this land can be put to by reason of its arid character) and from my observation as above referred to of the effect of removal of cattle from the upper forest region, it is imperative that some measure or measures must be adopted to save the lands, and it is the intention of the Raymond Ranch to formulate a plan whereby the upper part of these various lands, viz: Kanaio, Auwahi and Kahikinui, may be established as a permanent forest reserve and it is hoped and believed that when the said plan shall have been completed that the Government will lend its efforts to the project. It is the writer's belief that if such support is forth coming from the Government, that not only those particular lands may be saved but that the entire island of Maui will be benefited by the reforesting of the entire upper slopes of both sides of the mountain.

I remain,' Yours very truly,

J. H. RAYMOND,
District Forester, Districts of Kula, Ulupalakua and Kahikinui.

REPORT OF MR. L. VON TEMPSKY.

*Kula and Kaupo, Maui.*

Makawao, Maui, T. H., Dec. 14, 1906.

Dear Sir:—In accordance with the wishes expressed in your letter of the 22nd ult. I append herewith a report of work done in this and the Kaupo District for the last year or so.

*Present Extent of Native Forest:* The Makawao Forest, a portion of which is in my district, extends from the Maliko Gulch, which runs down the mountain on the eastern side of Olinda, clear round the mountain in an easterly direction to Nahiku; running mauka to an elevation of *about* 6,500 feet—Puu o Luuau being on the upper edge of the forest—and makai to about 2,400 feet.

The present condition of this forest is good. On the Haleakala Ranch Co.'s side it is securely fenced and the fence kept in good order. The growth of young trees since the exclusion of cattle

being very marked, these consist mainly of Ohia, Koa, Olapa, Naio, Pua and Mamani.

On the northern slope of Haleakala above the ordinary forest belt, and also in the Crater of Haleakala, the growth of young Mamani is something extraordinary. In some places, which formerly were open and clear, it is now next to impossible to get through on horseback; this in spite of the fact that there are just as many, if not more, cattle now than there used to be. This growth commenced about sixteen or eighteen years ago.

A great number of the old Koa trees are dead, or dying, from the effects of an insect which bores into the ends of the branches and later on kills the tree.

*Private Forest Reserve:* The Haleakala Ranch Co. has voluntarily fenced, and reserved, an area of over seven thousand acres of forest land; this land lies mauka of the Government Forest Reserve (Koolau), and the closing up of this land by the company, with a fence, has secured the government land from the depredations of cattle. The object of this reservation is to conserve the rainfall of the district.

The Haleakala Ranch Co. has not taken advantage of the law which allows of exemption of taxes on land reserved for forestry.

*Forest Planting:* The residents of the Makawao District have always been growers of trees, and the last year or two this industry has received a fresh impetus, due principally, I think, to the people seeing for themselves the amount of firewood that a grove of *Eucalyptus globulus* will produce in a few years' time. This is about the only tree the general public plant, I suppose from the fact that they are certain of its growing anywhere, and also that the seed can be had for the picking.

The Haleakala Ranch Co. has gone in systematically for the last seven years for planting and experimenting with trees and tree seeds, their object being, first, shade and shelter for cattle; later on, for the production of fence posts, railroad ties, firewood, etc., etc.; and incidentally, the general improvement in appearance of the company's property.

The general type of plantation established is an area varying from seven (7) to twenty-five (25) acres selected with a view to

sheltering the young trees, and later on the cattle, from the prevailing N. E. trade winds and rain. The trees are planted from 8 feet by 8 feet to 15 feet by 15 feet apart, as conditions require; and are securely fenced off from stock.

Furrows are plowed out and then the tree holes are prepared by "kipikua" work. The trees selected for planting are generally *Eucalyptus globulus* to windward, they being quickest to grow, and rapidly forming a breakwind for the more delicate and slower growing kind.

From the appended list of seventy-six (76) varieties of trees experimented with, I have come down to planting principally the following:

For Shade.—*Acacia melanoxylon, Grevillea robusta, Eucalyptus globulus, Eucalyptus robusta, Cupressus macrocarpa.*

For Fence Posts.—*Eucalyptus leucoxylon, Eucalyptus corymbosa.*

For Railroad Ties.—*Eucalyptus rostrata, Eucalyptus corynocalyx.*

There have been planted on the ranch since 1899 over 120,000 trees, eighty per cent. of which are growing and doing well; these are planted out in twenty-three (23) lots, besides avenues, along fences, etc., etc., in all over 250 acres, ranging in elevation from 300 feet at Waiopai and 2000 feet at Makawao to 6500 feet.

At 300 feet Kiawe is the only tree I plant, but there are trees of this sort now growing in Kula, at the 2500 feet altitude. I am selecting the seed from these trees and planting them still higher up. At what elevation they will cease to thrive remains for time to prove.

At the 6500 feet elevation I have planted the aforementioned nine varieties, also a number of pines; and strange to say, the pines are doing the least well of them all. Between 2000 feet and 6500 feet they all do well except that the *Acacia melanoxylon* is subject to the ravages of the so-called "Olinda beetle." If it were not for this set back, it would grow almost as rapidly as the rest of them.

The common Wattle that grows so successfully in the Kula District, I have found by experience to be the equal of, if not

superior to, the Hawaiian Koa for ox yokes, brake-blocks for wagons, etc., etc. If dried carefully it does not warp or crack, and is very durable. There ought to be quite a future for this tree in Kula as it grows, seeds itself, and thrives in the face of all that cattle can do to destroy it. I have noticed it growing down on the plains, at as low an elevation as 500 feet, and from there to 4000 feet it grows equally well.

I should like to have identified a tree I noticed growing near Hilo, at the residence of Mr. W. H. C. Campbell, manager of the Hawaii Mill Co. I have heard it called German Spruce. Whatever it is, it certainly grows as well as any tree I have seen in the Islands, and it might have quite a large commercial value. I know that these trees (there are eight or nine of them) are not more than six years old, as I was there at that time, and they were not even planted then. I have tried some seed I secured at the time I was there (last April), but am afraid the trees are too young for the seed to germinate, as so far I have had no success.

I should think it would be well worth the trouble when any officer of the Forestry Department is in Hilo, to look them up and identify them. I would give a good deal to get them growing on the slopes of Haleakala.

Respectfully submitted,

L. VON TEMPSKY,

Manager Haleakala Ranch Co.

LIST OF TREES EXPERIMENTED WITH BY HALEAKALA RANCH COMPANY TO NOVEMBER 30, 1906.

| Name. | Date Planted. | Remarks. |
|---|---|---|
| Ash | Jan., 1902 | Grows well at 5500 ft. elevation. |
| Acacia Baileyana | May, 1902 | Grows well; wonderful reseeder. |
| " Latifolia | Jan., 1905 | Grows well. |
| " Melanoxylon | Jan., 1904 | One of the best trees to plant. |
| " Pycnantha | Sept., 1906 | Grows well. |
| " Lopantha | Sept., 1906 | Grows well. |
| " Floribunda | Sept., 1906 | Grows well. |
| Beech, purple | Jan., 1902 | Grows well at 5500 ft. elevation. |
| Brachychiton Acerifolia | Sept., 1906 | Grows well. |
| Catalpa Speciosa | Jan., 1902 | Very slow of growth. |

| Name. | Date Planted. | Remarks. |
|---|---|---|
| Catalpa Bignonioides | Jan., 1902 | Did not grow. |
| Cryptomeria Japonica | Jan., 1902 | Did not grow. |
| Camphor | Jan., 1902 | Very well at 2000 ft. great reseeder. |
| Cupressus Macrocarpa | Jan., 1899 | Very good from 2000 to 5500 ft. el. |
| Casuarina | Jan., 1902 | Very good at 2000 ft. elevation. |
| Eucalyptus Robusta | Sept., 1901 | A 1 from 2000 to 5500 ft. elevation. |
| " Citriodora | Sept., 1900 | do. |
| " Globulus | Jan., 1899 | do |
| " Rostrata | Jan., 1899 | do |
| " Ficifolia | Jan., 1899 | Grows well 2000 to 4000 ft. el. |
| " Salignae | Jan., 1903 | Seed sterile. |
| " Marginata | Jan., 1903 | Seed sterile. |
| " Cordosa | Jan., 1903 | Seed sterile. |
| " Cerbera | Jan., 1903 | Does well. |
| " Coriacea | Jan., 1903 | do |
| " Pillularis | Jan., 1903 | do |
| " McArthurii | Jan., 1903 | do |
| " Longifolia | Jan., 1903 | do |
| " Sideropholia | Jan., 1903 | do |
| " Dephanophylla | Oct., 1903 | Seed no good. |
| " Obliqua | Apr., 1904 | do |
| " Leucoxylon | Apr., 1905 | Seed good, does well. |
| " Corymbosa | Apr., 1905 | do do |
| " Corynocalyx | Apr., 1905 | do do |
| " Paniculata | Sept., 1906 | Does well so far. |
| " Amygdalina | Sept., 1906 | do |
| " Botryoides | Sept., 1906 | do |
| " Siberiana | Sept., 1906 | do |
| " Rudis | Sept., 1906 | do |
| " Marginata | Sept., 1906 | do |
| Elm | Jan., 1902 | Grows well but for "Olinda beetle" |
| European Larch | Jan., 1902 | do do |
| German Spruce | May, 1906 | Seed did not sprout. |
| Grevillea Robusta | Jan., 1901 | Very good from 2000 to 4000 ft. el. |
| Ginko Biloba | Oct., 1902 | Sprouted and died. |
| Kamane | Jan., 1905 | Grew well. |
| Karaka | Aug., 1906 | Grows well so far. |
| Locust, black | Jan., 1902 | Grew well, Olinda beetles killed them. |
| " white | Jan., 1902 | do do |
| Linden | Jan., 1902 | Grows well but for Olinda beetle. |
| Maple, Norwegian | Jan., 1902 | do do |
| " Cutleaf | Jan., 1902 | do do |

| Name. | Date Planted. | Remarks. |
|---|---|---|
| Milo | Apr., 1903 | Does well makai. |
| Manele | July, 1906 | Grows well. |
| Maiden Hair tree | May, 1902 | 2 seeds sprouted, did not thrive. |
| Pua | May, 1902 | Did not grow. |
| Pinus Maritima | Jan., 1903 | Good seed, trees did not thrive. |
| " Torreyana | Jan., 1903 | do do |
| " Tuberculata | Jan., 1903 | do do |
| " Ponderosa | Jan., 1903 | do do |
| " Pinea | Jan., 1903 | do do |
| " Attenuata | Dec., 1904 | Seed sprouted, slow growth. |
| " Coulteri | Dec., 1904 | do do |
| " Insignis | Dec., 1904 | do grows well. |
| " Lambertiana | Dec., 1904 | do do |
| Picea Macrocarpa | Dec., 1904 | do slow growth. |
| Poplar, silver | Jan., 1902 | Grows well. |
| Rubber Ceara | May, 1906 | Slow growth. |
| Cork Oak | Mar. 29, 1902 | Sprouted, but did not succeed. |
| Sequoia Gigantea | Jan., 1902 | Growing well (one) but slowly. |
| " Sempervirens | Jan., 1903 | Seed no good. |
| Tipuana Speciosa | May, 1902 | Seed sterile. |
| Tulip Tree | Jan., 1902 | Grows very well at 2000 ft. el. |
| Uhiuhi | July, 1906 | do |
| Kiawe | Jan., 1899 | do |
| Syncarpia Laurifolia | May, 1902 | Did not grow. |

## REPORT OF MR. W. F. POGUE.

### *Koolau, Maui.*

Kailua, Maui, January 24th, 1907.

Dear Sir:—Complying with your request for a report on the state of the Koolau and East Hamakualoa Forest Reserve, I would state: That the fence from Halehaku to Makapipi, erected two years ago, has been kept in repair, all stock have been excluded and with few exceptions, and then for only a day or two, no stock have been at large above the said fence.

The renewal of the forest in places where formerly there was only Hilo grass, is very marked in some localities; young Paihi, Ohia Lehua, Kopiko, Haa, Koa and other native forest trees are coming up very thick in places.

In spots at Honomanu, Keanae, Nahiku the Ieie is dying

out, and many of the forest trees with it, the reason for which is not apparent.

There have been no forest fires since the erection of the so-called forest fence.

The residents living contiguous to this Forest Reserve are now reconciled to the exclusion of stock from above the forest fence, and, in not a few cases, are giving assistance in the preservation of the forest.

Respectfully submitted,

W. F. POGUE.

REPORT OF MR. T. S. KAY.

*North Kohala, Hawaii.*

Kohala, Hawaii, Dec. 31, 1906.

Dear Mr. Hosmer:—

I have your regarded favors of Nov. 22 before me. Regarding the information you call for about the forests in this district, I regret to say I cannot supply you with any information which you do not know, as I have made no investigations as to forest acreage.

There have been no forest fires during the past year in our district; there have been no additions to existing reserves.

Present reserves are in fine condition, becoming so dense that it is now impossible to get through the old trails; fences are in a fairly good condition, sufficient to prevent animals from doing any injury.

Private planting of trees in ravines and waste places has been carried on as usual.

A very fine, healthy belt of forest is now growing well along the sea coast in Halawa after many years of persistent effort, in all about 15 acres. Having had good success here, I would like to see the whole coast line planted up.

And as our effort is an object lesson, I hope in the near future to see others do this.

Believe me to remain, Yours respectfully,

THOS. S. KAY.

## REPORT OF MR. JOHN M. ROSS.

*North Hilo, Hawaii.*

Hakalau, Hawaii, T. H., 21st Dec., 1906.

Dear Sir:—In reply to yours of Nov. 22nd, requesting a statement from each of the District Foresters for your annual report, I will report as follows:

1. *Present Extent of Native Forest:* I would estimate the present limits of the native forest in my district to average six miles in depth by sixteen in length, or about 62,000 acres.

2. *Present Condition of Forest:* The forest condition is excellent, with a dense undergrowth of ferns, vines and shrubs. From the edge of the cane belt back for about a quarter of a mile or so, there are several dead or dying Ohias occasioned by former clearings in the near vicinity, but which are now being rapidly covered with Koa and dense undergrowth of ferns, shrubs and vines.

There has been no injury to the forest from any cause whatever during the past year.

3. *Private Forest Reserves:* There have been no areas of forest set apart as forest reserves excepting Government forest land. All private forests, which are owned by Bishop Estate, Pepeekeo Sugar Co. and Hakalau Plantation Co., and other private owners, are controlled by the respective owners, but are preserved for the preservation of forest as well as conserving our water supply.

From Makahanaloa right across to the lands of Honohina the upper forest boundary is fenced. From Honohina across Piha and Maulua the forest is protected by a strip of raspberry bushes so dense that sheep cannot get through, and as this unfenced strip lies makai of the sheep ranch the forest is practically protected from the inroads of cattle or sheep.

The preserving of our forests on these Islands is one of the many judicious acts of our present Executive and the future will more fully illustrate to us the far-sightedness of this policy of preserving our forests, upon which all of our running streams are dependent, and all credit is due to private owners for their coöperation in this laudable policy for the good of the country at large.

*4. Tax Exemption of Forest Land:* Forest that is fenced off and treated as a reserve may be exempted from taxation. No advantage is derived from this provision as all are assessed the same. In levying assessments there is no regard, in my opinion, as to what an equitable valuation would be, but rather to increase year by year if there is no appeal, or in other words, let the willing horse take all the load he can possibly haul for the present, with utter disregard for his future.

*5. Forest Planting:* Under this head Mr. Pullar of the Honomu Sugar Co. and Mr. Webster of the Pepeekeo Sugar Co. have informed me that they are doing some planting under the supervision and recommendation of your office so that you are familiar with what is being done. On Hakalau there has been nothing done in the way of tree planting.

Respectfully submitted,

JOHN M. ROSS,
District Forester, North Hilo.

## REPORT OF MR. JOHN A. SCOTT.

*South Hilo, Hawaii.*

Wainaku, Hilo, Hawaii, Dec. 20th, 1906.

Dear Sir:—Yours of the 22nd Nov. was duly received and contents noted.

*Present Condition of the Forest:* I have nothing new to report on the condition of the forest, as I am not aware that it has been injured in any way during the past year, except that on the upper side near W. H. Shipman's ranch, there were a number of the old and mature trees blown down by a strong wind that prevailed during the early days of March.

*Private Forest Reserves:* The lands of Kikala, Alae and Kalalau, belonging to the Bishop Estate, under lease to the Hilo Sugar Company, and the fee simple land of Puueo, are the only private lands that are included in the forest reserve in this section, and they are being maintained as forest reserves by the owners. For

the maintenance of the water supply to the streams, as with the continued clearing off of the forest, the flow of the streams has been in late years seriously affected.

The area of the above lands under forest must be in the neighborhood of 1300 acres.

*Forest Planting:* The Hilo Sugar Company is endeavoring to reforest a tract of land on Punahoa 1st with Black Wattle trees, but as the young plants have only been set out a short time, it is too early to report success.

Yours very truly,

JOHN A. SCOTT,

District Forester.

## REPORT OF MR. JOHN WATT.

*Puna, Hawaii.*

Olaa, Hawaii, Dec. 20th, 1906.

Dear Sir:—Beg to acknowledge receipt of yours of the 22nd inst., regarding forest in this district.

*Present Extent of Native Forest:* The Puna forests may be said to consist of two large belts of woods separated by the pahoehoe lava flow lying to the eastward of the Volcano road.

The heaviest belt, that to the westward, contains about 62,000 acres and is mainly of Ohia wood, while Koa is present at the higher altitudes.

To the westward the forest has been destroyed by lava flows and exists largely as pockets, with the exception of the woods between Pohoiki and Panau.

This section contains about 111,000 acres, or about 173,000 acres for the district.

*Present Condition of Forest:* The forest here is in its usual healthy condition as far as I have seen it.

*Private Forest Reserves:* There are no private forest reserves in the District of Puna.

*Tax Exemption of Forest Land:* None of the land owned privately in this district has been properly fenced so as to comply with the law, therefore no tax exemption of forest lands exists in this district.

*Forest Planting:* No forest planting has been done here, properly speaking. A few rubber trees have been set out at different points, but more as an experiment than any attempt at reforesting.

*Forest Fires:* There have been no fires in the forest within the past twelve months with the exception of numerous fires in that portion of the district lying between the Puna Plantation and Olaa Plantation.

The forest in this part of the district is very, very scattering, small, scrubby trees, growing in the cracks in the pahoehoe. The country is covered with a thin growth of Hilo grass and the ranchmen have frequently set fire to the grass during dry weather. This has undoubtedly done some damage to the scattering trees, but no attempt was ever made to extinguish the fires.

I have, on several occasions, called the ranch-owner's attention to these fires, but so far he evidently has not been able to prevent the parties living in that district from setting fire to the grass.

Several grass fires were also caused by people passing along the road and dropping burning cigarettes and matches.

I have nothing further of interest to communicate in this report.

I respectfully remain, Yours very truly,

J. WATT,
District Forester.

## REPORT OF MR. JULIAN MONSARRAT.

### *Kau, Hawaii.*

Kapapala Ranch, Pahala, Kau, Hawaii, Dec. 2nd, 1906.

Dear Sir:—In reply to your letter requesting a report from me on forestry conditions in my division, beg leave to reply as follows to your questions:

*Present Extent of the Native Forest:* I hardly know how to answer this, as a "concise description of the native forest" in my

division is a difficult question to answer, unless you are ready, and willing to expend money for surveys, "for the purpose of comparison in future years." Am not good at guessing. All forest reservations that *should* be, *have been* made, under the "Forest Reserve in the District of Kau," dated and signed by Governor Carter, August 2nd, 1906, and containing an area of 65,850 acres. In passing would mention the fact, that the Hawaiian Agricultural Company in February, 1896, completed the construction of a fence 31 miles in length, around the greater portion of this reserve, at their own expense, and have kept this fence in good repair ever since, at an annual expense of $1000.00, not including an extra outlay of some $4000.00. The fence enclosed a large area of good pasture land, and it was also necessary to kill off a large number of cattle, for which they have never asked the government a "rebate" on their leases. It may also be well to mention the fact that there was nothing in their leases compelling them to erect this amount of fencing.

*Present Condition of the Forest:* Is very good, and the young trees show a remarkable growth within the reserve, more especially the Koa and Ohia Lehua. The larger trees were injured somewhat by the storm of a year or so ago, a number having been blown down. Where Koa is protected by undergrowth, nothing seems to injure it, except strong winds.

*Private Forest Reserves:* None. [But note the second paragraph above.—R. S. H.]

*Tax Exemption of Forest Land:* Know of none, or that any advantage has been taken of the law. Guess the government get all that is coming to them in the way of taxes, and more too, all right, all right.

*Forest Planting:* The Hawaiian Agricultural Company have, within a year, set out some eight thousand trees, consisting principally of Monkey-pods, which Mr. W. G. Ogg, the manager, informs me withstand the severe droughts of this district much better than any other variety. This company have started two large nurseries with the intention of planting a large area of waste and other lands this coming year, and are experimenting with a variety of trees, with the object in view of finding varieties that will

prove good drought resisters. They expect to set out some hundred thousand trees next year, weather permitting. In this connection, beg to state that this is an expensive, and unsatisfactory district in which to plant trees, owing to the uncertainty of the weather. I have found this so from experience. To make tree planting a success in this district, requires a great deal of care, labor and expense.

*Forestry in General:* The Koa, outside of the reserve, is fast dying out, being attacked by a borer and other pests. In my opinion it would be far better to find some parasites, which would destroy these pests than it is to form mahogany companies, for as it looks to me this borer is a more rapid worker than the saw and axe. The combination of borer, saw and axe will soon clean out all the Koa, unless something is found to destroy the former, and that very soon. There is no Koa outside of the reserve that might be classed as commercial.

Steps should be taken to pass a law during the coming Legislature to prevent the cutting of young trees within the forest reserves, also for pay of forest rangers.

In my opinion it is very necessary that an appropriation for a traveling entomologist should be asked for from the Legislature.

Respectfully yours,

J. MONSARRAT.

## REPORT OF MR. ERIC H. EDWARDS.

*South Kona, Hawaii.*

Papa Ranch, Hoopuloa, Hawaii, January 5, 1907.

Dear Sir:—I herewith beg to send in a small report which I trust will be of some interest.

In re the present limits of the forest in this district, it is practically the same as of yore, and as for the condition, I have not noticed any injuries to it during the past year. Where there are cattle running they are apt to bark trees of various sorts but not to any very great extent.

No forest reserves have been set apart in this district during the past year.

During the past year, Mr. R. v. L. Domkowicz has planted out various trees: "Logwood," "Jacaranda," "Lebanon Cypress," "Medeira Mahogany," "Rubber," Gum trees of various kinds, "Kou," "Milo," "Ironwood," "Camphor," etc., all of which are making good growth.

This is, I think, all I can say on the subject this year, as practically no changes have taken place in the conditions during the past year.

Yours very truly,

ERIC H. EDWARDS.

## REPORT OF MR. G. W. McDOUGALL.

*South Kona, Hawaii.*

Hookena, South Kona, Hawaii, Dec. 8th, 1906.

Dear Sir:—Yours of Nov. 22 wishing a report on subject of forest in my district which I believe extends from Ahupuaa of Hookena to Ahupuaa of Kaohe in the District of South Kona.

Taking the average elevations of present native forest in my district, it will be about from 1,800 feet elevation up to 5,500 feet elevation. There are portions of the forest in my district as low down as 12 to 1,500 ft. elevation, and on Hookena, the Mamani forest runs up to 6,500 to 7,000 ft. elevation.

The general condition of the forest is dense and uninjured, except in one portion between Honokua and Hukuiopae. In this portion cattle are being run in the forest, and they are barking and killing young Koa and other trees which have a soft juicy bark.

These cattle men are located on private land, but the cattle go over Government land and all, and as the boundaries between the different lands are not known up in the forest, I cannot see how a stop can be put to same until boundaries have been located.

Very respectfully,

G. W. McDOUGALL.

## REPORT OF HON. JOHN D. PARIS.

### *Central Kona, Hawaii.*

Kealakekua, Dec. 27, 1906.

Dear Sir: In accordance with your request, I hereby submit my report as forester for Central Kona:

There has been very little change in the condition of the forest in my district since my last report.

The heavy forest belt is about three and a half to four miles deep and is composed mostly of Koa and Ohia, intermixed with Kolea, Pua, Opiko, Olomea and Pilo, with an undergrowth of ferns and vines.

I have noticed very few insects or blights, except the worm which eats the leaves of the Koa tree. These have been very numerous this year and in many places the Koa trees have been denuded of foliage, but their life is short and the leaves soon grow out again.

*Forest Reserves:* The only forest reserve in South Kona is the heavy forest on the lands of Kahauloa, Keei and Honaunau, belonging to the Bishop Estate. This is about three miles deep and four or five miles wide, and is mostly heavy forest. It has been fenced for about four years. It has grown up a jungle and in many places fine young Koa and Ohia trees are pushing up through the undergrowth.

A like reserve will probably be made on the lands of Keauhou and Kahaiuu, belonging to this Estate.

*Forest Planting:* Very little has been done here in this line, as we have fine forests already planted. What is needed is to preserve them and not wait until it is too late. The Territory should set an example and see that all forest tracts and public lands are protected.

The Algaroba trees are increasing along the sea cosat and large portion of the Kona coast could be covered with them if an equal interest was taken in planting them.

*Forest Fires:* No fires of any consequence have occurred. A small fire started at the upper edge of the woods at Honokua, but was put out before any serious damage was done.

The general forest belt of Central Kona is in good condition, excepting those portions owned by private parties and heavily stocked with cattle, there the forest is disappearing.

I remain, Yours truly,

J. D. PARIS,

Forester for Central Kona.

REPORT OF MR. J. A. MAGUIRE.

*North Kona, Hawaii.*

Hueiue, Kailua, Hawaii, Dec. 14, 1906.

Dear Sir:—I herein submit my report on Forestry, in reply to yours of Nov. 22nd. There are no new conditions in regard to the forest of North Kona.

This report is almost a repetition of my former ones.

The Government has set aside a Forest Reserve of fine Koa on a part of the land of Honuaula, and has thus made a step forward in the preservation of the forest covered slopes of Hualalai. The Bishop Estate, I believe, has given its consent to the reservation of part of their forest land adjoining.

Kona is all a Native Forest, except where clearance has been made by the small farmers or native homesteaders. Along the sea coast where the lava flows have emptied into the sea are the barren spots. If the owners of the lands along the sea coast would only make it compulsory for their tenants to plant cocoanut trees, there are many little fertile sand beaches that might be made attractive and useful by planting the cocoanut palm. As an inducement and help to the poor Hawaiian tenants, the owners of the lands might furnish them with the young plants and make a stipulation in their leases to have them fence and care for the plants.

Between here and Puuwaawaa is a virgin forest of native trees found nowhere else on the whole group, seeds of which are being collected for the Experiment Station. These trees flourish on the bare lava with apparently very little soil. The Koa forest, which

has been enclosed in the reservation of Honuaula, already begins to show the good effects of protection. The Mamani above the Koa belt on the southerly slope of Hualalai is increasing very rapidly, spreading towards the summit.

There are no private forest reservations in this section. There is very little tree planting, except a few fruit trees. The climate of Kona is so mild that it is the ideal place for the cultivation of tropical fruits, but the market and the means of transportation are so limited that there is very little fruit cultivation. The trees grow wild, no care being taken of them, and naturally the fruit is inferior and does not bear transportation. The drought of the past two years made great inroads in the growth of the forest, but recent rains have started the seeds and where they are protected from cattle grow very rapidly. My district has so far been very fortunate in escaping from forest fires.

The lantana blight has done very fine work, aided by the dry weather. What growth there is now is not strong, and in a few years I think the land will be quite clear.

Yours respectfully,

J. A. MAGUIRE,
Forester for the District of North Kona.

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## LIST OF THE DISTRICT FORESTERS.

(Corrected to December 31, 1906.)

Following is a list of the (forty) District Foresters with their respective jurisdictions:

### KAUAI.

ALBERT S. WILCOX.

In and for the District of Halelea.

FRANK SCOTT.

In and for the District of Koolau, excepting the land of Anahola.

GEORGE H. FAIRCHILD.

In and for the land of Anahola and the northern portion of the District of Puna, extending as far as the land of Wailua.

F. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua, except the lands controlled by Grove Farm Plantation.

EDWARD BROADBENT.

In and for those lands in the District of Puna, controlled by the Grove Farm Plantation.

REV. J. M. LYDGATE AND WALTER D. McBRYDE.

In and for that portion of the District of Kona, lying to the east of the Hanapepe Valley.

FRANCIS GAY.

In and for that portion of the District of Kona, lying between and including the Waimea, Poomau and Kauaikanana Valleys on the west and the Hanapepe Valley on the east.

AUGUSTUS F. KNUDSEN.

In and for the District of Na Pali and that portion of the District of Kona, formerly known as the District of Waimea, lying to the west of the Waimea, Poomau and Kauaikanana Valleys.

**OAHU.**

ANDREW ADAMS.

In and for the District of Koolauloa.

L. L. McCANDLESS.

In and for that portion of the District of Koolaupoko extending from Koolauloa to the land of Heeia.

W. C. WEEDON.

In and for that portion of the District of Koolaupoko extending from and including the land of Heeia to the land of Kailua.

JOHN HERD.

In and for that portion of the District of Koolaupoko extending from and including the land of Kailua to Makapuu Point.

PAUL R. ISENBERG.

In and for that portion of the District of Kona extending from Makapuu Point to and including Manoa Valley.

WALTER F. DILLINGHAM.

In and for the Districts of Ewa and Waianae.

A. M. NOWELL.

In and for the District of Waialua.

**MOLOKAI.**

JAMES MUNRO.

In and for the Island of Molokai, excepting that portion between the lands of Pukoo and Halawa, inclusive.

C. C. CONRADT.

In and for the portion of the east end of the Island of Molokai, lying between the lands of Pukoo and Halawa.

**LANAI.**

CHARLES GAY.

In and for the Island of Lanai.

**MAUI.**

H. P. BALDWIN.

District Forester at Large for the Island of Maui.

L. BARKHAUSEN.

In and for the District of Lahaina.

C. B. WELLS.

In and for the District of Wailuku.

H. A. BALDWIN.

In and for the District of Hamakuapoko and the western half of the District of Hamakualoa.

W. F. POGUE.

In and for the District of Koolau and the eastern half of the District of Hamakualoa.

C. J. AUSTIN.

In and for the District of Hana.

L. VON TEMPSKY.

In and for the District of Makawao.

L. VON TEMPSKY and DR. J. H. RAYMOND.

In and for the Districts of Kula, Honuaula, and the lands beyond, to and including Kaupo.

**HAWAII.**

T. S. KAY.

In and for the District of North Kohala, and that portion of the District of Hamakua lying between the District of North Kohala and the Waimanu Valley.

E. E. CONANT.

In and for the District of South Kohala.

DAVID FORBES.

In and for that portion of the District of Hamakua from and including the Waimanu Valley to the District of Hilo.

JOHN M. ROSS.

In and for that portion of the District of Hilo extending from the District of Hamakua to the land of Makahanaloa.

JOHN A. SCOTT.

In and for that portion of the District of Hilo extending from the District of Puna to and including the land of Kikala.

JOHN WATT.

In and for the District of Puna.

JULIAN MONSARRAT.

In and for that portion of the District of Kau extending from the District of Puna to and including the land of Punaluu.

GEORGE C. HEWITT.

In and for that portion of the District of Kau extending from the land of Punaluu to the District of Kona.

ERIC H. EDWARDS.

In and for that portion of the District of South Kona extending from the District of Kau to the land of Kaohe.

WM. R. CASTLE and GEO. W. McDOUGALL.

In and for that portion of the District of South Kona extending from and including the land of Kaohe to the District of North Kona.

JOHN D. PARIS.

In and for that portion of the District of North Kona extending from the District of South Kona to and including the land of Kahaluu.

JOHN A. MAGUIRE.

In and for that portion of the District of North Kona extending from Kahaluu to the District of South Kohala.

# LIST OF DISTRICT FIRE WARDENS.

(Corrected to December 31, 1906.)

Following is a list of the (fifty) District Fire Wardens, with their respective Districts:

**CHIEF FIRE WARDEN**

RALPH S. HOSMER,

Superintendent of Forestry, *ex officio*

**DEPUTY FIRE WARDEN AT LARGE**

DAVID HAUGHS.

In and for the Territory of Hawaii.

**DISTRICT FIRE WARDENS.**

**KAUAI.**

C. W. HUDSON.

In and for the Wainiha Valley, District of Halelea.

W. F. SANBORN.

In and for the District of Halelea, excepting the Wainiha Valley.

FRANK SCOTT.

In and for the District of Koolau, excepting the land of Anahola.

GEORGE H. FAIRCHILD.

In and for the portion of the Districts of Koolau and Puna, extending from the land of Anahola to the land of Olohena, inclusive.

F. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua.

REV. J. M. LYDGATE.

In and for that portion of the District of Kona, formerly known as the District of Koloa.

FRANCIS GAY.

In and for that portion of the District of Kona, lying between and including the Waimea, Poomau and Kauaikanana Valleys on the west and the Hanapepe Valley on the east.

AUGUSTUS F. KNUDSEN.

In and for the District of Na Pali and that portion of the District of Kona, formerly known as the District of Waimea, lying to the west of the Waimea, Poomau and Kauaikanana Valleys.

**OAHU.**

ANDREW ADAMS.

In and for the District of Koolauloa.

FRANK PAHIA.

In and for that portion of the District of Koolaupoko, extending from the Koolauloa District line to the land of Heeia.

GEORGE CAMPBELL.

In and for that portion of the District of Koolaupoko, extending from and including the land of Heeia to the land of Kailua.

JOHN HERD.

In and for that portion of the District of Koolaupoko, extending from and including the land of Kailua to Makapuu Point.

CHARLES H. BAILEY.

In and for that portion of the District of Kona, extending from Makapuu Point to Palolo Valley.

H. J. RHODES.

In and for Palolo Valley, District of Kona.

W. M. GIFFARD.

In and for that portion of the District of Kona, lying between Pauoa and Manoa Valleys.

G. H. MOORE.

In and for Pauoa and Nuuanu Valleys, District of Kona.

WALTER F. DILLINGHAM.

In and for the District of Ewa and that portion of the District of Waianae lying to the East of the Waianae Mountains.

F. MEYER.

In and for that portion of the District of Waianae lying to the West of the Waianae Mountains.

BYRON O. CLARK.

In and for that portion of the lands of Wahiawa and Waianae-uka, lying to the east of the main Government road from Ewa to Waialua.

A. M. NOWELL.

In and for the District of Waialua.

**MOLOKAI.**

JAMES MUNRO.

In and for the Island of Molokai, excepting that portion between the lands of Pukoo and Halawa, inclusive.

C. C. CONRADT.

In and for that portion of the east end of the Island of Molokai, between the lands of Pukoo and Halawa, inclusive.

**LANAI.**

CHARLES GAY.

In and for the Island of Lanai.

## MAUI.

H. P. BALDWIN.

Fire Warden at Large, for the Island of Maui.

LOUIS BARKHAUSEN.

In and for the District of Lahaina.

R. C. SEARLE.

In and for the District of Kaanapali.

C. B. WELLS.

In and for the District of Wailuku.

H. A. BALDWIN.

In and for the District of Hamakuapoko and the west half of the District of Hamakualoa.

W. F. POGUE.

In and for the District of Koolau and the east half of the District of Hamakualoa.

JOHN CHALMERS.

In and for the District of Hana.

HUGO HANEBERG.

In and for the District of Kipahulu.

J. H. RAYMOND, M. D.

In and for the Districts of Honuaula and Kahikinui.

L. VON TEMPSKY.

In and for the Districts of Kula and Kaupo.

**HAWAII.**

T. S. KAY.

In and for that portion of the north half of the District of Kohala, extending from the land of Kaauhuhu to the Hamakua District line.

SAM. P. WOODS.

In and for that portion of North Kohala, extending from the northern boundary of the land of Kawaihae I to and including the land of Kaauhuhu.

E. E. CONANT.

In and for the District of South Kohala.

DAVID FORBES.

In and for the western part of the District of Hamakua, extending to the boundary of the land of Paauhau.

JAMES GIBB.

In and for that portion of the District of Hamakua, extending from the western boundary of the land of Paauhau to the boundary of the land of Kukaiau.

ALBERT HORNER.

In and for that portion of the District of Hamakua, extending from and including the land of Kukaiau to the Hilo District line.

JOHN M. ROSS.

In and for that portion of the District of Hilo, extending from the Hamakua District line to the land of Makahanaloa.

JOHN T. MOIR.

In and for that portion of the District of Hilo, extending from and including the land of Makahanaloa to the land of Kikala.

JOHN A. SCOTT.

In and for that portion of the District of Hilo, extending from the Puna District line to and including the land of Kikala.

JOHN WATT.

In and for the District of Puna.

WILLIAM G. OGG.

In and for that portion of the District of Kau, extending from the Puna District line to and including the land of Punaluu.

CARL WOLTERS.

In and for that portion of the District of Kau, extending from the land of Punaluu to the Kona District line.

ERIC H. EDWARDS.

In and for that portion of the District of Kona, extending from the Kau District line to and including the land of Kaapuna.

GEORGE W. McDOUGALL.

In and for the portion of the District of Kona, extending from the land of Kaapuna to and including the land of Hookena.

JOHN D. PARIS.

In and for that portion of the District of Kona, extending from the land of Hookena to and including the land of Kaawaloa.

T. C. WHITE.

In and for that portion of the District of Kona, extending from the land of Kaawaloa to the land of Kahaluu.

JOHN A. MAGUIRE.

In and for that portion of the District of Kona, extending from the land of Kahaluu to the Kohala District line.

## FOREST RANGER.

DAVID KAPIHE.

In and for that section of the District of Kona, Island of Oahu, bounded on the east by Manoa Valley, on the north by the Konahuanui Mountain Range, on the west by Pauoa Valley and on the south by the makai edge of the eucalyptus forest, the Makiki reservoir and the mauka boundary of the Judd land in Makiki and Manoa.

# Report of the Librarian.

Honolulu, Hawaii, Dec. 31, 1906.

Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:

Under the authority conferred on me by the Board at a meeting held on March 9, 1904, when it was resolved that the library and the routine work of the office be placed in my charge, I have the honor to submit the following report for the past year.

## LIBRARY.

The statute creating the Board provides that "it shall be the duty of the Board to secure copies of the laws of other States, Territories, and countries, and other publications germane to the subject matter of this Act, and make the same available for public information and consultation."

The aim of the library is to cover the field of general agriculture in its relation to tropical and sub-tropical conditions, especial attention being paid to the collection of publications having to do with Botany, Entomology, Forestry and Animal Industry. The library now numbers between four and five thousand books and pamphlets, besides serial publications in completed volumes and currently received.

Accessions to the library are received through purchase, gift and exchange, the attempt being made, as opportunity and means permit, to secure the standard authorities and the other more important books in the several branches of Natural Science named above.

The policy of the Board is to maintain its library as a free reference library, open to the public, daily, during office hours. As yet the library has not been used as generally as could be wished. This is probably due in part to the fact that some

of those who could most profitably use it are not able to do so because of not residing in the vicinity of Honolulu, while others who might consult the library are not aware of what it has to offer. To meet the latter objection the Board staff has lost no opportunity of calling the attention of the public to the existence of the library and of cordially extending an invitation to all to make use of it. During the latter part of 1906 more persons visited the library than at any previous time and those who came were almost without exception persons who could and did profit by so doing.

An important feature of the library is the current periodicals regularly received. A full list was given in the Report of the Board for 1905, and need not be repeated here.

In the purchase of new books during the year the aim has been to add to the standard works on Entomology and Forestry now on the shelves and to continue systematically the collection of Floras of tropical and sub-tropical countries in all parts of the world.

Among the important accessions received by purchase during 1906 may be mentioned the following:

| Title. | *Botany.* | Author. |
|---|---|---|
| Flora Capensis (7 volumes) | | Harvey & Sonder |
| Flora, British India (7 volumes) | | Hooker |
| Flora, Tropical Africa (8 volumes) | | Oliver & Thiselton-Dyer |
| Flora, Mauritius and the Seychelles | | Baker |
| Flora, British West Indian Islands | | Grisebach |
| Flora, Madeira | | Lowe |
| Flora, Southern United States | | Chapman |
| Flowering Plants of Western India | | Nairne |
| Vascular Plants from Surinam | | Pulle |
| Southern Wild Flowers and Trees | | Lounsberry |
| The Tree Book | | Rogers |
| History of Botany | | Sachs |
| Plant Geography | | Schimper |
| Enumeration of Hawaiian Plants | | Mann |
| Indigenous Flowers of the Hawaiian Islands | | Sinclair |
| Pflanzenfamilien (Phanerogams) (11 vols.) | | Engler & Prantl |

*Forestry.*

The Forester .....Nisbet
Handbuch der Forstwissenschaft .....Lorey
Wald, Klima und Wasser .....v. Liburnau
Die Klimate der Erde .....Woeikof
Einwirkungen des Waldes .....Ebermayer
Forst Asthetik .....v. Salisch
Fortwissenschaft .....Fischbach
History of the Lumber Industry of America .....Defebaugh
Timbers of Commerce .....Stone
Principal Species of Wood .....Snow
Trees .....Ward
Studies in Forestry .....Nisbet
Forest Utilization, Mensuration and Sylviculture ..Schenck
Manual of Forest Engineering for India .....Rogers

*Entomology.*

Butterflies of the West Coast .....W. G. Wright
The Coccidae of Kansas .....S. J. Hunter
Microscoper's Vade Mecum .....A. B. Lee
American Almanac of Photography.
Entomology .....J. W. Folsom
Explanations of Terms Used in Entomology .....J. B. Smith
American Insects .....V. L. Kellog
Trans. Ent. Soc. London (1877-1890)
The Entomologist (1840-1905)
Entomologists' Monthly Magazine (1864-1905)
Anatomy of the Blow-fly (2 vols.).....Lowne
List of Hemiptera in the British Museum .....Dallas
A large number of important Coccid papers and a number of separates bearing on our native insect fauna.

*General Science.*

A Naturalist on the River Amazon .....Bates-Clodd
A Naturalist's Wanderings in the Eastern Archipelago.Forbes
The Malay Archipelago .....Wallace
Land Revenue of British India .....Baden-Powell

On Seedlings .....Lubbock
Research Methods in Ecology .....Clements
Odorographia .....Sawyer
New Creations in Plant Life .....Harwood
Irrigation Farming .....Wilcox
Tropical Agriculture .....Nicholls
Volcanoes of the Hawaiian Islands .....Brigham
The Teaching Botanist .....Ganong
Classification of Flowering Plants .....Rendle
Treatise on the Physiology of Plants .....Sorauer
Disease in Plants .....Ward
Timber and Some of Its Diseases .....Ward

*Rubber.*

Para Rubber (Second edition) .....Herbert Wright
The Chemistry of India Rubber .....Carl Otto Weber
Coffee and India Rubber in Mexico.....Romero
India Rubber, Gutta-Percha, and Balata .....Brannt

Matters in connection with the books and publications on Entomology have been handled by Mr. Jacob Kotinsky, of the Division of Entomology, who has also directed the preparation of a card catalog (by author, subject and series) of the Entomological publications. Later this catalog will be extended to cover the other books in the library.

The recording of the accessions of current periodicals and the arrangement of the magazines on the library shelves was performed by Mr. David Haughs up to May, 1906. Since then it has been done by Miss Ella K. Dayton, the clerk of the Division of Entomology, who has also carried out certain other routine work in connection with the library.

## USE OF THE BOARD ROOM.

Besides serving as the library, the large room in the office building is used for the regular meetings of the Board and also, through the courtesy of the Commissioners, for the meetings of other organizations having to do more or less directly with the advancement of agricultural science.

During the year forty-eight evening meetings have been held. The following list gives the names of the organizations and the number of meetings held by each:

| | |
|---|---|
| Hawaiian Entomological Society ..... | 12 |
| Honolulu Improvement Advisory Board .. | 13 |
| Pawaa Improvement Club ..... | 3 |
| McCully Improvement Club ..... | 4 |
| Waialae, Palolo & Kaimuki Imp. Club..... | 3 |
| Farmers' Institute ..... | 2 |
| Hawaiian Poultry Association ..... | 11 |
| Total ..... | 48 |

Because of its accessibility and because it is well lighted, screened, and of sufficient size to accomodate the organizations that use it, the Board room is well adapted for such meetings. That the privilege of using the room is appreciated by the several societies is attested by several votes of thanks that have been passed during the year. From this use of its building the Board gains the advantage of bringing the public in touch with the work done by its several divisions and with the resources of its library.

During the year the Board itself has held nine regular meeting in its office; three special meetings were also held down town. Seven forest reserve hearings have also been held during the year in the office of the Board, to secure expressions of public opinion on various forest reserve projects.

## EXHIBITS OF FRUITS AND WOODS.

The collections of fruits, indigenous woods, and seed from island grown trees continue to arouse interest not only in visitors to Honolulu but also among local residents. The collection of fruits contains many specimens never seen in the markets. During the year a number of particularly rare fruits have been added, which will repay a visit of inspection.

As in the past Mr. Alexander Craw has had charge of preparing the fruits for exhibition, a task requiring skill and careful attention to detail.

*Visitors.*

During the year 262 persons have registered in the record book, kept in a conspicuous place near the entrance to the building. The record by months is as follows:

| | |
|---|---|
| January | 32 |
| February | 16 |
| March | 44 |
| April | 17 |
| May | 16 |
| June | 18 |
| July | 13 |
| August | 10 |
| September | 23 |
| October | 25 |
| November | 21 |
| December | 27 |
| Total | 262 |

As many persons forget or neglect to sign the register this does not represent all those who have visited the office during the year, nor does it include more than a small part of the persons who have called to consult members of the staff on one subject or other in connection with the work of the Board.

## ROUTINE WORK.

In common with many similar organizations much of the time of the staff of the Board of Agriculture and Forestry is consumed with routine work. Owing to the necessity for frequent reports there is more stenographic work and typewriting to be done than would perhaps appear from the size of the staff, while the regular correspondence of the Board is steadily increasing.

A record kept by the stenographer for the "Board" and "Forestry" letters, shows that during the year letters were prepared and sent out as follows: Board business, 58; Library, 55: Division of Forestry, 584; Forest Nurseryman, 405; Forest Fire business, 100; total, 1,202.

Bearing in mind the absence of the Superintendent of Forestry during the early summer months, this is a decided increase over the correspondence of former years.

Miss Melika Peterson has continued during the year as general clerk of the Board and stenographer of the Division of Forestry. Her faithful and conscientious service deserves more than passing recognition.

*Distribution of Seed and Publications.*

In the early part of the year the distribution was completed of the 1905 quota of congressional vegetable seed, furnished by the Delegate to Congress and, with the coöperation of the Superintendent of Public Instruction, sent out through this office to the various public schools throughout the Territory. As long as the seed lasted every family represented in each school had a share. In all something over 15,000 packages of seed were sent out.

In August the Delegate sent his quota of the U. S. Department of Agriculture Yearbook for 1905 to be distributed through this office. Copies were sent to each public school principal and to all who applied under an offer published in the newspapers. Some copies of the 1905 and also of the 1903 yearbooks still remain on hand. They may be had on application.

The second Report of the Board of Agriculture and Forestry, for the year 1905, delayed in preparation, was finally issued on Oct. 13, 1906. An edition of 2,500 copies was struck off and in addition 500 separates of the report of each of the four divisions were printed for distribution to divisional correspondents outside of the Territory. The full report was widely distributed throughout the Territory.

To facilitate the sending out of this report and to do certain other extra clerical work, Miss Marie Legros was appointed in October for a temporary period as special clerk. She continued to serve at the end of the year.

*Forester and Agriculturist.*

The publication of the Hawaiian Forester and Agriculturist, a

monthly magazine issued under the direction of the Board, has been continued during the year. This journal is devoted to Forestry, Entomology and Agriculture and to the development of what are locally termed the "allied industries." Under the efficient editorship of Mr. Leopold G. Blackman, it has come to have an established place among local periodicals.

The Forester and Agriculturist deserves a much wider circulation than it now has, for each volume contains many valuable contributions of general interest to those concerned with Agriculture under sub-tropical conditions. The 1906 volume (No. III) contains 422 pages, illustrated by 11 plates and 1 wood cut. The financial condition of the Board does not permit the free distribution of the Forester and Agriculturist. Accordingly, while issued under the auspices of the Board, the magazine is published by the Hawaiian Gazette Company of Honolulu, from whom it may be obtained. To subscribers anywhere in the United States the yearly rate is one dollar; to those in foreign countries, one dollar and a quarter.

## BUILDINGS AND GROUNDS.

A few minor changes have been made in the office building during the year, the most important being the completion in January of the rebuilding of the book cases in the library room and the construction of a map case in the office of the Superintendent of Forestry. At the same time improvements were made in the Entomological laboratory and in the insect-proof room, particularly by the construction in the laboratory of a cabinet, specially designed for controlling the light, for careful work with the compound microscope.

Of the changes in the other buildings on the Nursery grounds the most important is the transformation of the old fumigating house into a modern dark room, equipped with water, gas, and special appliances for the convenience of the photographer. The dark room is for the use of all of the Board staff, though so far only entomological work has been done in it. The dark room was constructed in August.

Earlier in the year an addition was made to the stable, which permitted the rearrangement of the stalls and gave

more room for the carriage shed and the feed and harness room. There are now one regular and three box stalls. These changes were made necessaray by the needs of the Division of Animal Industry. By the erection of a partition at one end of the wagon shed a seed room was obtained in which are stored the seed collected in and around Honolulu.

By the resignation of Mr. C. J. Austin, the cottage in the Nursery grounds until recently occupied by him is made vacant. No disposition had been made of it on December 31. As Mr. Austin has several times pointed out, the house is out of repair. It must be put in order before it can again be occupied.

*Grounds.*

No noticeable changes have been made in the nursery grounds during the year except the completion of an entrance driveway, begun in 1905, on the east side of the Board building. In connection with the making of the roadway, the stable yard was filled in with coral rock and black sand. The sidewalks about the nursery grounds were given a top dressing of black sand at the same time. The grounds are kept in condition with the aid of two prisoners detailed by High Sheriff Henry. Without these men it would be impossible to maintain the grounds in satisfactory shape. A good deal could still be done toward making the nursery more attractive. It is expected that a number of improvements can be made during the coming year.

Very respectfully,

RALPH S. HOSMER,
Librarian.

# DIVISION OF ENTOMOLOGY.

## Report of Superintendent of Entomology and Inspector.

Honolulu, T. H., December 31st, 1906.

To the
Honorable Board of Commissioners of
Agriculture and Forestry,
Honolulu, T. H.

GENTLEMEN:—I take pleasure in submitting to you a brief synopsis of the work done by your Division of Entomology during the year 1906.

### INSPECTION OF IMPORTATIONS.

During that period we have boarded 355 steam and sailing vessels from which were discharged and inspected 202,374 packages of fruits and vegetables from outside the Territory, out of which we returned or destroyed 697 packages infested with injurious insects or plant diseases. Beside the above we received 77 bales and cases of plants and trees that we fumigated with hydrocyanic acid gas. By mail there arrived 603 packages of small plants and seed. Even in such small packages we found and preserved samples of injurious insects and diseases that would have been established on these Islands if not intercepted.

**INFESTED JAPANESE RICE.**

During the months of September and October we found importations of the old crop of Japanese rice to be infested with larvae of a small brown beetle (*Tenebroides mauritanicus*) and numbers of "Rice weevils" (*Calandra oryza*). The former is only found in the fall in old rice, and shipment of this rice was forbidden, by cable, to be sent here. Upon the arrival of the new crop rice in November it was found to be entirely free from the above pests.

Upon the arrival of the first shipment of "old crop" rice which was found infested, we were granted permission by Acting Collector of Customs, R. C. Stackable, to make a thorough test of fumigating the rice in the sacks, with carbon bi-sulphide in one of our large fumigating chambers, with a strength of half a pound of the bi-sulphide to every 100 cubic feet of enclosed space. After an exposure of twenty-four hours we found the fumes had penetrated the sacks and rice, killing both larvae and weevils. At your request and by courtesy of the Hon. James Wilson, Secretary of Agriculture, and the U. S. Department of the Treasury, Mr. Stackable was directed by the latter department to withhold delivery of the rice until after fumigation and report by your entomologist that the work was satisfactory. We soon used up all the carbon bi-sulphide to be had in town and sent a cable message to San Francisco for two hundred pounds more, which arrived at the end of October. During the intermission we tested the efficacy of hydrocyanic acid gas in a large chamber, using an ingeniously contrived outfit so as to avoid the possible danger of inhaling any of that deadly gas. Large tubs were used, in each of which was placed a ten gallon wooden tub, and into the latter was poured the necessary amount of water, and commercial sulphuric acid. Over each of these tubs was suspended by a strong cord a paper sack containing ten pounds of 98°-99° per cent. cyanide of potassium. In all, one hundred pounds were used at one charge. The method referred to above, so as to avoid any danger to the operators, was to extend the cord from each tub distributed in the chamber, to the door where they were screwed. The farthest package of cyanide was lowered first, and when all were lowered, the door was closed and sealed with paper and paste and remained closed for thirty-six hours, after which it was ventilated by the aid of a powerful electric fan. Upon examination it was observed, however, that this gas did not penetrate the grain as thoroughly as the carbon bi-sulphide did, and several of the larvae and weevils were still alive; so the chamber was again sealed up and remained until the arrival of the bi-sulphide; with the latter the work was throughly done. In all, we fumigated 22,924 sacks of Japanese rice. The importers paid for the chemicals and the work in handling the sacks. No damage

to the grain is caused by the fumigation, either in its value as a food or its germinative power.

**SOIL BALLAST CONDEMNED.**

On Sunday, July 15th, the large four-masted American iron ship "Atlas," arrived from Yokohama, with a cargo of soil ballast containing vegetable matter and roots. As the laws of this Territory, and your regulations positively prohibit the landing of such material, we notified the Master and the Agents of the vessel that they would have to discharge her cargo of ballast into the ocean outside the harbor. After some objections on the part of the representatives of the vessel the regulations were finally complied with.

**NEW FUMIGATORY.**

When it was found necessary to fumigate packages arriving by mail we have heretofore had to remove them to one of our fumigatories on the docks. To expedite this work we, with the Executive Officer's consent and Postmaster Pratt's permission, have now an outfit in the postoffice. As we use chemical gases, no building is in danger of fire from their use.

**IMPROVEMENT IN OUR FUMIGATORIES.**

Our fumigatories are now all fitted up so that we can use heavy as well as light gases, enabling us to treat grape roots whene there is danger of introducing *Phylloxera* thereon. These insects are very small and have a preference to locate under the rough bark on the roots, but when treated with carbon bi-sulphide before they are planted, nothing of that kind can escape.

**PRACTICALLY NO DAMAGE FROM FUMIGATION.**

We are frequently informed by parties that have received plants—more especially small plants by mail—that their plants were killed by fumigation; whereas, the fact is, that very seldom plants or fruit when treated in our fumigatories are even injured, as we fully understand the amount of gas each species will stand, and the exact number of cubic feet in the fumigatory is known, whereas in the treatment of trees or shrubs growing out doors, the space under the tents has to be estimated. Parties receiving plants seldom or never take into consideration that their plants have been in transit, under conditions other than natural, from eight to twenty days. In most instances with such plants

as heliotrope, etc., the roots are sometimes dried and shriveled up, and other plants are packed tight in boxes with all their foliage, to heat and rot, arriving in anything but growing condition and instead of their being injured by the inspectors, or by fumigation, we frequently are the means of rescuing plants from death, by removing the rotted leaves or stems, or by applying a little moisture to those that are suffering from lack of it. The Postmaster or one of his assistants' attention is always called to packages when they arrive in bad condition.

## INSECTS AND OTHER PESTS FOUND UPON IMPORTATIONS.

I will here briefly enumerate some of the pests that have been stopped the past year. Among scale insects we found some lemon trees arriving in January, by mail from Florida, that were infested by a white wax scale (*Ceroplastes floridensis*). The owner's attention was called to the condition of the trees, after which they were burned. On the S. S. "Hong Kong Maru" that arrived on the 23rd of October, fourteen small tea plants were found infested with this same scale from Japan, and destroyed. Another importation of five tea plants from Japan in May, were infested with the partial "mining scale" (*Pseudaonidia duplex*). This pest also attacks orange trees, camellias and a great variety of shrubs. In the same package was a plant of *Lespedeza bicolor*, a low growing shrub with small violet-purple flowers, that was completely covered with a species of *Aspidiotus* scale unknown to me. This and the tea plants were destroyed by fire; the balance of the plants in the case were fumigated with hydrocyanic acid gas. Two tea plants and a *Sanchezia* plant came by mail from Florida infested with scale insects about the same time and were also burned.

*Retinosporas* are generally free from scale insects, but a plant that came from Japan was found with a colony of healthy *Dactylopius* sp. that appeared to thrive on that plant as a food. The tree was destroyed; a sample of the infested plant was put up in a tube as an office specimen.

**INFESTED ORANGE TREES.** On a shipment of citrus trees from California, we found some larvae of "black" and "cottony cushion" scales, and after a thorough fumigation the trees were passed; we already have both species on the Islands, together with their natural enemies and parasites that keep them in check.

**ORTHEZIA INSIGNIS.** A package of plants was received by mail, in which we found a *Salvia* plant infested with the so-called "Maui Blight" (*Orthezia insignis*), figured on page 127 of your report for 1905. This plant was destroyed. Unfortunately this insect has been widely distribubted by stockmen in the hope that it would kill out the Lantana plant that was rapidly destroying their pasture lands. While it checked the vigor of the Lantana it in no case destroyed it like the insects that were introduced specially for that purpose. The *Orthezia* unfortunately seriously attacks a variety of economic trees and plants. The *Salvia*, above referred to, was destroyed and the owner and shipper were both notified.

**OTHER PESTS.** Besides the foregoing scale insects, we have found on imported trees and fruit samples of several species of scale insects that are already well established on the Islands, including the disastrous "purple" (*Lepidosaphes beckii*), the "Florida red" (*Chrysomphalus ficus*), the "orange red" (*Aspidiotus aurantii*), and that white pest (*Pseudococcus nipae*) of the "Alligator pear." A consignment of plants arrived from Cuba that was slightly infested with the latter pest. This was my first knowledge of the existence of that pest there. Its apparently limited numbers there may be accounted for either by parasitic checks or by recent introduction. An effective parasite for this pest would be of incalculable value to this Territory, and Mr. Koebele's attention will be called to its existence there.

Besides scale insects, we occasionaly find vegetables or plants infested with larvae or egg clusters of insects, which are either destroyed or fumigated. In the case of trees or plants, these borers are always dug out or the infested plants are burned. In this class we have destroyed trees from the Southern States which were infested with larvae of the "peach root borer" (*Sanninoidea exitiosa*). We have even found small trees by mail infested by the same pest.

**FUNGUS DISEASES.** Various fungi have been detected upon plants, trees and fruits coming from outside the Territory, and all such have been destroyed. These included plum, orange and other plants, also sugar cane.

**SUGAR CANE PESTS.** A consignment of sugar cane arrived May 8th ex S. S. "Manchuria" from Formosa, via Hong Kong. As a precaution we fumigated the case before unpacking it to guard against the possible escape of any insects that had hatched on the voyage. Upon subsequent inspection frequent evidence of small borers was found. The cane was also black in places from the "honey dew" exuded by mealy bugs secreted under the base of leaves. Under the circumstances it was deemed necessary to burn the cane, including the packages.

During my vacation in August my assistants, Messrs. Kotinsky and Austin, intercepted another importation of sugar cane cuttings, which on this occasion came from Fiji ex S. S. "Miowera." These, after fumigation, showed signs of having been punctured by leaf and cane hoppers. The cane was burned not only on this account, but because of unmistakable signs of fungi on the stalks. I have since learned from a resident in Fiji of the existence of a very serious fungus disease in sugar cane on that island.

On December 20th, two packages of sugar cane cuttings arrived by mail from Florida. The cane was very slender and in sampling, it evidently contained a very low percentage of saccharine matter. The cane was discolored in places evidently by some insect. The cane and packages were burned.

**INFESTED MANGO SEED.** On Sunday, June 10th, the transport Sheridan arrived from Manila. In her mail was a tin box of mango seed packed in charcoal. Upon inspection the seeds were found to be badly infested with small eight-legged silvery mites. The owner was notified and the condition of the seed was shown him, after which the entire lot, also the packages and wrappers, were burned.

## LOCAL INSPECTION WORK.

**MANGO WEEVIL.**

In my weekly report to you of October 2, 1905, I called your attention to the existence of a mango fruit pest in two sections of Oahu. Mr. Austin and I immediately visited these districts, but found the crop of mangoes over for that season. Upon examination of a few fallen dry seeds under the trees we discovered several larvae and beetles, afterwards identified as *Cryptorhynchus mangiferae,* Fabr. We called the attention of the Superintendent of the estates to the existence of the pest, and requested him to have all the seed collected and burned, which was done.

During the past season Mr. Austin and I made a careful examination of the cultivated mango trees on Oahu, and found the above pest distributed from Palama valley to within a mile of Pearl City. During the fall of 1905, Mr. Van Dine first called attention to its existence on Oahu, and his estimate then was that sixty per cent. of the fruit in the original district was infected. An elderly Hawaiian living at the head of a small valley which we visited on our investigating trip, stated that he had known of its existence in his mangoes three seasons before our visit. From the enormous size of the trees and the character of the undergrowth and soil I fear that it is too late to attempt the extermination of this pest. As the weevil is found inside the seed, there appears to be very little damage done other than destroying its germinating power.

**AN EFFORT TO EXTERMINATE THE INDIAN MANGO SCALES.**

Previous to the enactment of the Plant Inspection law a shipment of Indian mango trees was imported and planted without fumigation, and during this summer they were found to be infested with the "mango scale" (*Coccus mangiferae,* Green), and a small white undescribed species resembling a *Pollinia.* Last August, obeying your orders, the trees were all fumigated with hydrocyanic acid gas. The trees were then making some new wood and the work was performed after sun down to prevent any serious injury from the actinic rays. Even with this precaution a slight scorching of the very tender twigs was noticeable, but two weeks later a thrifty new growth was sprouting all over the fumigated trees; and, what

was more satisfactory, was the fact that upon further examination we failed to find a single living scale of either species. All immediately adjacent mango trees were also fumigated.

**NEW SCALE INSECT.**

In October a small package was received at this office from Kauai containing a twig of "Norfolk Island Pine" (*Araucaria excelsa*) infested with a cottony scale which Mr. Kotinsky determined to be *Pseudococcus aurilanatus*. This scale is a native of Australia, and was occasionally found upon small Araucarias entering San Francisco, but they succumbed readily to fumigation. The owner reported that he had found the scale on two small Araucarias that he had received by mail. He was advised to dip the trees in whale oil soap solution, which was done, and he afterwards sent sample twigs showing that the scales were all dead.

## INTRODUCTION, BREEDING AND DISTRIBUTION OF BENEFICIAL INSECTS.

This section of work which has continued in charge of Assistant Entomologist Jacob Kotinsky, has progressed satisfactorily during the past year. The work has largely been the care, breeding and distribution of beneficial insects, including new importations, recently established species, as well as some of the older established forms. Other features of the work have been the study of injurious insects, especialy scale insects, and their enemies; the usual routine of biological and systematic work; correspondence and imparting information to visitors.

### NEW IMPORTATIONS OF BENEFICIAL INSECTS.

In all, 14 consignments of useful insects were received during the year. Besides the collections sent in by Mr. A. Koebele from California and Arizona, we were also favored with one colony of ladybirds from California by Mr. E. M. Ehrhorn; one of ladybirds from Fiji by Mr. F. Muir, of the Hawaiian Sugar Planters' Association Experiment Station; and five colonies of scale enemies from China and Japan by Mr. Geo. Compere. Grouped according to host, these new six-footed immigrants may be classified as enemies of (*a*) horn fly, (*b*) scale bugs, (*c*) aphis or plant lice, and (*d*) army and cut worms.

(*a*) **ENEMIES OF HORN FLY.**

By far the largest and most numerous consignments of beneficial insects received during the year were enemies of the horn fly. These comprised an extensive variety of predators and two species of parasites. Neither of the latter, so far as could be ascertained, is a specific enemy of the horn fly, though one of them, referred to later as the "Arizona dung-fly parasite," was bred from horn fly pupae. The predators were beetles that habitually either live in cattle dung and feed upon the living maggots therein, or "tumble bugs" which disintegrate the dropping shortly after deposition, thus preventing the breeding of flies therein.

THE ARIZONA DUNG-FLY PARASITE (*Eucoila impatiens,* Say.) In his search for useful insects for the Territory, Mr. Koebele has concentrated his attention on the horn fly, taking enemies of our other pests, as Avocado pear scale and cutworms, incidentally. On the 5th of May, of this year, the "Alameda" brought, among other things, a box with dipterous pupae collected in dung in the vicinity of Nogales, Arizona. They were packed in sphagnum moss and kept at about 40° F. aboard the steamer. In the laboratory they were gradually brought to our normal temperature, and then segregated and put away for breeding. A little less than a month later males and females (Fig. 1) of the above named parasite began to issue. They were immediately supplied with two large jars full of cattle droppings well stocked with dipterous larvae and pupae that usually inhabit it. As fast as other specimens of the parasite issued they were placed in these jars. Twenty-five days later a large brood of the parasite made its appearance in the jars, and systematic distribution among ranchmen on the Islands and at

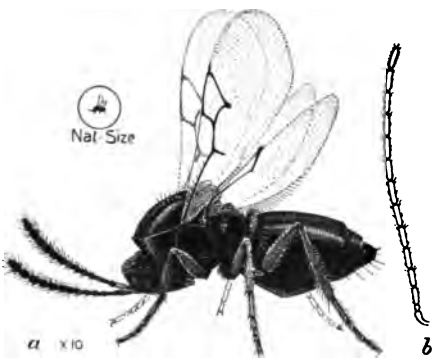



Fig. 1. Arizona horn fly parasite (*Eucoila impatiens*, Say): *a*, female; *b*, antenna of male. Both magnified 10 times. The natural size is given in the circle. (Original; by W. E. Chambers.)

the heads of the valleys in the vicinity of Honolulu immediately commenced. A portion of the brood was retained and two fresh jars stocked with it for further breeding and distribution. So far as we are aware, nearly all stock breeders on the Islands have been supplied with colonies of the useful insect.

It is now beyond doubt that the parasite does and will attack the horn fly larva and pupa, though it will probably show preference to the larger hosts breeding in the same medium. But even in the latter event it cannot but prove useful, both directly and indirectly. Directly, by reducing the numbers of the larger flies that inhabit cattle droppings. Indirectly by reducing the numbers of the larger maggots and pupae as a source of food to the mynah bird and other predators and thus compelling them to feed on the smaller fry, including horn fly larvae and pupae. No opportunity was yet open to ascertain whether the parasite has been established on the Islands, but the facility with which large numbers were bred in confinement encourages the hope that this useful ally will make itself at home on our Islands. Once established much of the success of its introduction will depend upon the intelligent manipulation by ranch managers and owners in distributing parasitized pupae over their respective lands.

For the identification of this fly we are indebted to Dr. W. H. Ashmead, through the courtesy of the U. S. Bureau of Entomology, Washington, D. C.

The Lesser Dung-Fly Parasite (*Eutrias* sp.). This is a small four-winged fly, in general appearance very much like the preceding parasite, though only about half the size. It was bred from dung-fly pupae sent by Mr. Koebele per "Sonoma," which arrived in Honolulu Aug. 11th. After securing Mr. Perkins' assurance that it is a dipterous parasite, a number were released, and others were retained in the laboratory for breeding purposes. Although exactly the same method of breeding was pursued as with the other parasite, no results were forthcoming.

Carrion and Dung Beetles (*Histeridae*). Each of the five consignments of desirable insects collected and sent by Mr. Koebele from Nogales, Arizona, contained a lot of these bettles in the pupa and adult stages. The immature forms were kept in the laboratory until maturity and then released. As indicated in the distribution table below, they were distributed over the Islands as widely as possible.

"TUMBLE-BUG" (*Copris carolina,* Linn.). Large numbers of this beetle were received alive and immediately released in suitable localities. This was the largest among the manure beetles received. It is dark brown, ungainly in appearance, almost an inch long, little less wide, and over half an inch thick (Fig. 2). "These insects act the part of scavengers by breaking up and burying the droppings of cattle and other animals. The female *Scarabaeus* detaches a portion of the dung and forms it into a ball, sometimes as large as the fist; this it rolls along by means of its hind legs, by pushing when necessary with its broad head, or by walking backwards and dragging the ball with its front legs. The strength and patience displayed by the creature in the execution of this task are admirable."*

Fig. 2. One of the Tumble bugs (*Copris carolina*, Linn.) from Arizona released on these Islands. (Original; photograph by Dr. Cobb.)

OTHER MANURE INHABITING BEETLES. At least six other species of dung beetles were received and distributed. In distributing them, variety of climate was provided these immigrants in order to give them every possible opportunity for propagation and carrying on the good work for which they were intended.

**(*b*) SCALE BUG ENEMIES.**

Among our scale bug pests perhaps none attract more attention than the "Avocado mealy bug" (*Pseudococcus nipae*, Mask.), also known as "Alligator pear scale." As a matter of common observation this scale insect, which attacks also fig, banyan, bread-fruit, mulberry, guava and numerous other plants, is regularly each year,

* Sharp, Cambridge Nat. His., Insects II, p. 196

usually during the winter months, reduced to comparative non-importance by the black ladybird (*Rhizobius ventralis,* Ericks.). But when it gains the ascendency over its enemy during the summer it is very conspicuous by virtue of its white color, especially of the males, and becomes a subject of general complaint. For enemies of this, among scale insects, therefore, Mr. Koebele has given especial attention in his expeditions of the past year. Messrs. Muir, Ehrhorn and Compere also kindly assisted in this work by sending ladybirds that fed in their respective homes upon allied pests.

Following is a list of this group of insects received during the year:

| LADYBIRDS. | DIPTERA. | HYMENOPTERA. | NEUROPTERA. |
|---|---|---|---|
| *Exochomus pilatei*, Muls. | Syrphus. | A variety of chalcids and encyrtids. | Hemerobiid. |
| *Exochomus marginipennis*, Lec. | Geomyzid? | | |
| Scymnids. | | | |
| *Hyperaspis lateralis*, Muls. | | | |
| *Chilocorus cacti*, Linn. | | | |

Avocado Mealy Bug Enemies. The first named ladybird (*Exochomus pilatei,* Muls.) seemed a promising foe of the Avocado mealy bug, upon which it fed while under observation in the laboratory before being released. The Scymnids and *H. lateralis* were released in prodigious unmbers upon trees infested with this pernicious pest.

Numerous internal parasites (*Hymenopterous*) were bred from mealy bugs (*Ceroputo bahiae* and *Phenacoccus* sp.) sent by Mr. Koebele from California, and released, after eliminating hyperparasites and questionable species. A Dipteron (Geomyzid) and lace-wing fly (Hemerobiid) were also bred from this material and released. None of these having as yet been definitely named, specific mention is omitted.

Purple Scale Parasites. Two large consignments of carefully packed almond twigs thickly infested with what is doubtless

the "apple tree bark-louse" (*Lepidosaphes ulmi,* Linn.), or a closely allied species, were received from Hong Kong, China, sent by Mr. George Compere. From these a very pretty Chalcid (*Perissopterus* sp.) was bred and a number released upon trees infested with purple scale. These consignments were received August 14th and September 4th, respectively.

Mr. Muir has sent to Dr. Perkins, of the Hawaiian Sugar Planters' Entomological Division, citrus leaves infested with parasitized purple scale from China. We are informed that many parasites were bred and released by Dr. Perkins and staff.

FLORIDA RED SCALE PARASITE. On September 4th, the "Nippon Maru" brought also a small Cycas plant thickly infested with the above scale (*Chrysomphalus aonidum,* Linn.=*Aspidiotus*

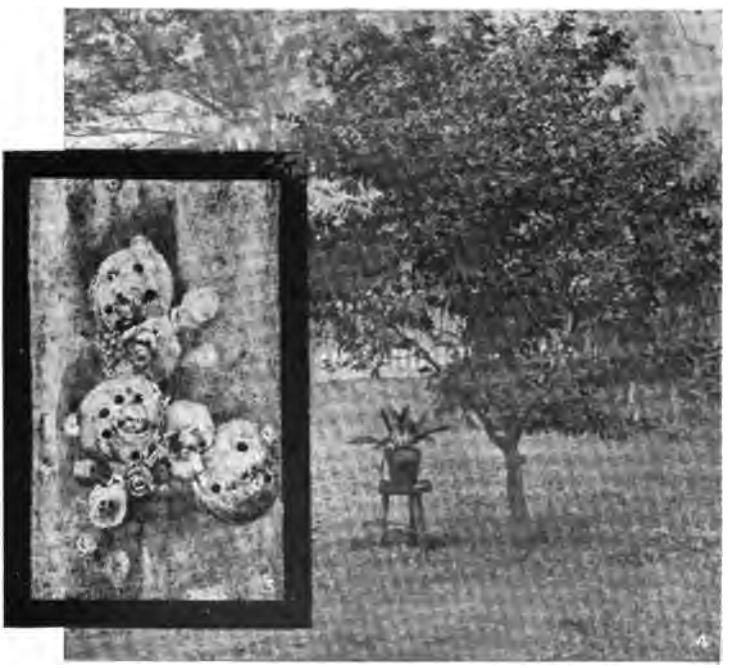


Fig. 3. *Chrysomphalus aonidum,* Linn., on bit of Cycas leaf from China, showing exit holes of parasite. The uncommon number of these holes (1 or 2 is the usual number in armored scale insects) indicates the probable effectiveness of the parasite. Magnified about 10 times.

Fig. 4. The Cycas with the above parasitized scale, potted, in the Government Nursery under an orange tree infested with the same scale. (Original; photographs by Jacob Kotinsky, arranged by E. M. Grosse.)

*ficus*, Ashm.) many of which showed 5-7 exit holes (Fig. 3) of a parasite. This plant came in good condition and after careful inspection was potted and placed beneath an orange tree (Fig. 4) well stocked with the scale.

PARASITES OF THE ORANGE RED SCALE (*Chrysomphalus aurantii*, Mask.) Two species of parasites were bred from this scale upon cuttings kindly left by Mr. Compere on his way to California aboard the "Nippon Maru," December 11, 1906. Several pairs of these parasites were released in the Government Nursery grounds on a tree infested with this scale. Of the two parasites one was a Chalcidoid, and the other a very pretty Encyrtid.

**(c) ENEMY OF APHIS OR PLANT LICE.**

FIJIAN LADYBIRD (*Arcaioneda tricolor*, var. *fijiensis*, Crotch). If established this will be the largest ladybird on the Islands, being about 8 mm. (1/3 in.) long, 7 mm. wide and 3 mm. high, or about twice as large as the red spotted ladybird (*Coccinella repanda*). It is light brown ochre in color with a narrow black stripe on the medio-dorsal line. The eggs, laid in batches of a dozen or less, and the larvae, are proportionately large, the latter being in addition armed closely with heavy spines and gaudily colored with transverse bands of orange and purple.

On February 12 we were presented by the H. S. P. A. Experiment Station entomologists with 10 adults, a number of larvae in various stages and egg batches of this ladybird. These were successfully bred in the laboratory until the middle of May, and the adults distributed from time to time. Here they were fed entirely upon aphis principally from sorghum. At no time were they observed to eat mealy bug, although they were confined with it for days, and Mr. Muir, who collected them in Fiji, has found them upon mealy bugs. About 30 days was consumed in the development from egg to imago, and on an average about 25 per cent. of the eggs under observation reached maturity.

**(d) ARMY AND CUT WORM ENEMIES.**

Several consignments of very large, black, flattish ground beetles (*Carabidae*, *Calosoma* spp.) (Fig. 5) were sent by Mr. Koebele from Arizona. These are predaceous insects that in the young and full grown stages habitually feed on other

insects, particularly caterpillars in or close to the ground. Many of these were released in suitable localities.

Fig. 5. One of the ground beetles (*Calosoma* sp.) from Arizona released on these Islands. (Original; photograph by Jacob Kotinsky.)

**RESULTS TO BE EXPECTED.**

Time alone will tell the result of the release of these various insects. This result, however, can only be either positive or neutral, depending upon whether or not the insects are established and how rapidly they increase. No evil effects need be apprehended for the reason that all the insects released were of either predaceous or parasitic habit, and no insect is known to abandon carnivorous diet for vegetarian.

**PREVIOUSLY ESTABLISHED BENEFICIAL INSECTS.**

SIPHANTA OR TORPEDO BUG PARASITE (*Aphanomerus pusillus*, Perk.) This useful little ally reported last year as established and doing effective work in its new home, has since been found thoroughly established on a coffee plantation on this Island and numerous colonies were sent from there to Hamakua, Hilo and Kona, Hawaii, and Haiku, Maui. At the Forester's Cottage up Nuuanu Valley, where formerly Siphanta was exceedingly

abundant upon the Eugenia trees, it is now a decidedly uncommon insect, so thorough has been the work of the parasite.

**EXPERIMENT WITH THE JAPANESE BEETLE.**

(*Adoretus umbrosus,* var. *tenuimaculatus,* Waterh.) Upon returning from Fiji, Mr. Muir reported the cacao plants of that country saved from the ravages of a beetle closely allied to the above, by means of a fence of bamboo sticks about 1 inch in diameter, placed 1½ inches apart, 3 or 4 inches from the plants and rising about 10 inches above the plant.

Fig. 6. These vines were grown indoors and placed in June in the Government Nursery grounds near a grape arbor badly infested with Japanese beetles, and a ¾ inch. mesh screen placed over one of them, as shown in the illustration. The photograph was taken ten days later. But the beetles were too much even for the screen for it was subsequently penetrated by them and the vine ruined. (Original; photograph by Jacob Kotinsky.)

To ascertain the effect of a similar fence upon our very much abused rose bushes by the Japanese beetle, lath and ¾-inch mesh wire screens were used in the construction of similar fences. At

first the results were quite encouraging, as illustrated by the photograph (Fig. 6) which was taken 10 days after putting up

Fig. 7. This lath paling (the laths are 1½ in. wide and 1½ in. apart) was built about the rose bush last June. The photograph was taken in December. Part of the fence was removed to expose to advantage the rose bush within. It will be observed that the leaves within the fence were scarcely touched by the beetles, though they were somewhat injured by tailor bees (the round cuts). The only explanation to this fact that can be offered is that the beetles are apparently reluctant to pass the barrier. The branch above the fence was stripped by the beetles, yet this branch was able to make the growth because of the protection afforded in early development, since an identical rose (not shown in the illustration) made no headway at all for the beetles. The advantage of the fence over a lath house for roses is that it is much cheaper and allows the tops of the bushes to remain open and exposed to the sun,—an important factor in rose culture. (Original: photograph by Jacob Kotinsky.)

the experiment. The day following, however, the beetles penetrated the screen and commenced the destruction of the plant. The photograph of the rose (Fig. 7) shows, however, that in the long run a certain degree of protection is afforded the plant that is fenced in.

## COLONIES OF BENEFICIAL INSECTS DISTRIBUTED DURING 1906.

| Name. | Hawaii | Maui | Molokai | Oahu | Kauai |
|---|---|---|---|---|---|
| HORN FLY ENEMIES. | | | | | |
| Arizona dung fly parasite (*Eucoila impatiens* Say) | 19 | 11 | 5 | 26 | 12 |
| Histers | 1 | 2 | 1 | 5 | .... |
| Manure beetles | 26 | 12 | 12 | 19 | 25 |

| Name. | Hawaii | Maui | Molokai | Oahu | Kauai |
|---|---|---|---|---|---|
| SCALE BUG AND APHIS ENEMIES. | | | | | |
| Fijian ladybird (*A. fijiensis*) | .... | 2 | .... | 8 | 1 |
| *Chalcaspis* sp | .... | .... | .... | 6 | .... |
| Chalcidoidea (Misc.) | .... | .... | .... | 4 | .... |
| *Cryptolaemus montrouzieri* | .... | .... | .... | 1 | .... |
| *Exochomus pilatei* | .... | .... | .... | 1 | .... |
| *E. marginipennis* | .... | .... | .... | 2 | .... |
| Hemerobiid | .... | .... | .... | 6 | .... |
| *H. lateralis* | .... | .... | .... | 9 | 1 |
| *Perissopterus* sp | .... | .... | .... | 2 | .... |
| Scale eating fly (Geomyzid) | .... | .... | .... | 6 | .... |
| Scymnids | .... | .... | .... | 2 | .... |
| Syrphus fly | .... | .... | .... | 2 | .... |
| *Vedalia cardinalis* | .... | .... | .... | 1 | .... |
| Parasite from Florida red scale (*Chrysomphalus aonidum* Linn.) | .... | .... | .... | 1 | .... |
| Parasites from Orange red scale (*Chrysomphalus aurantii* Mask.) | .... | .... | .... | 2 | .... |
| CUT WORM ENEMY. | | | | | |
| *Calosoma* spp. | 2 | 2 | 1 | 3 | 1 |
| MISCELLANEOUS. | | | | | |
| Siphanta egg parasite (*A. pusillus*) | 18 | .... | .... | 1 | .... |
| Japanese beetle fungus | .... | 1 | .... | 1 | 1 |
| Lantana Insects | 4 | .... | .... | 1 | 1 |

NOTE. It will be observed that the largest number of colonies of beneficial insects was released in Oahu, i. e., principally in and near Honolulu. The cause for this apparent partiality is obvious. If a useful insect is established it is desirable to have is as near the office as possible to facilitate further distribution. In the case of many insects immediate release is imperative and the best locality in the environs of the office was therefore chosen.

## GENERAL REMARKS.

**NEW FRUIT TREES.** We have on various steamers to Brisbane, Queensland, forwarded packages of *Ceroplastes rubens* to Mr. Leslie G. Corrie, President of the Queensland Acclimatization Society, in hopes of introducing into that country the hymenopterous parasites that now keep that formerly damaging introduced scale insect in check on these Islands. In return for our efforts Mr. Corrie has very kindly

sent us—freight prepaid—three new mandarin orange trees of a variety that originated there and is considered to be the finest mandarin orange in the world. One of the trees was planted on the uplands of Tantalus; one in Nuuanu Valley and the other on the outskirts of Honolulu. This will thoroughly test their adaptability to various elevations. Buds will be taken later from them for general distribution. A variety of persimmon, a mango tree called "Rose," and three small coccus palm trees were also sent. We appreciate and thank Mr. Corrie for his kindness.

**ECONOMIC PLANTS FROM WASHINGTON, D. C.**

Four large cases of "cacao" (370 plants) and six small mango trees arrived ex S. S. "Alameda" from the Department of Agriculture, Washington, D. C., via San Francisco. The former from their appearance had been thoroughly treated with Bordeaux mixture to destroy any fungi spores; on the mango tree we found a few very small "Florida red scale" (*Chrysomphalus ficus*), which upon microscopic examination we found were dead, evidently having been fumigated before shipment.

**A CEYLON SUGAR CANE PEST.**

Mr. George Compere, the beneficial insect collector for California, passed through Honolulu, December 11th, on his way to California from India and the Orient. While in Ceylon he observed a very destructive leaf hopper on cane and brought samples of the larvae and imago in a vial of formalin; he presented me with a few which I gave to the Entomological Division of the Hawaiian Sugar Planters' Association. To be forewarned is to be forearmed, and sugar cane or similar plants coming from Ceylon will receive careful examination and treatment.

**AN IMPORTATION OF FIBER PLANTS.**

In February a resident of Oahu imported three cases—1000 plants—of New Zealand flax (*Phormium tenax*); a careful examination did not reveal any insects or fungi. However, we examined each plant and then fumigated them, also the cases and packing. It is a fiber plant and great quantities of the fiber in bales enters San Francisco on nearly every steamship from New Zealand. Mr. Byron O. Clark of Wahiawa, intends testing it to see if it cannot be profitably grown on these

Islands. As it requires better land and more moisture than sisal I doubt if it will be as profitable as that plant.

**CHOICE LIMES.** During November we received a package of limes from Mr. W. W. Taylor of Kipahulu, Maui, samples of which we have on exhibition; they compare favorably with Mexican or California grown limes and should be extensively grown, and would command good prices when California lemons are scarce.

**DARK ROOM.** The original fumigating house, figured on Plate VII of your report for 1905, located on your experimental grounds, has not been used for that purpose since the construction of other rooms on the docks, and has been converted into an up to date photographic "dark room" where the various divisions of your Board can develop their photographic plates of subjects pertaining to their work.

**THE PORT OF HILO.** With your consent, two fumigatories have been built at Hilo, on the Island of Hawaii, and a quarantine officer, Mr. B. M. Newell, was appointed by your Board in August to take charge. One fumigatory was constructed on the principal dock, and the other at the postoffice.

Respectfully submitted,

ALEXANDER CRAW,
Superintendent of Entomology and Inspector.

# Report of Prof. A. Koebele.

Alameda, California, Dec. 31, 1906.

To the

Honorable Board of Agriculture and Forestry,
Honolulu, T. H.

GENTLEMEN:—I herewith submit some field notes on enemies of the Alligator pear scale, Hornfly and other insects, sent to Honolulu during the year.

The study of enemies of Leaf-hoppers has been continued in California, Arizona and Sonora, the result of which will appear elsewhere.

## PARASITES AND PREDATORY INSECTS FORWARDED FOR *PSEUDOCOCCUS NIPAE.*

Several lots of a Coccid, related to the Alligator pear scale, found abundantly on *Salicornia* were sent, with the following insects breeding on the same:

(1) A Chalcid parasite, frequently met with, was contained in every parcel sent.

(2) Two species of *Hyperaspis,* of these *H. postica,* Lec., was by far the most numerous. The round species appears to be *H. limbatus,* Casey. The first named was found during the later part of 1893, on roots of a bunch grass infested with a Dactylopiid, in company with *H. depressa,* Casey, *Hyperaspidius comparatus,* Casey, and *Scymnus debilis,* Lec., all of which were sent to the Islands at that time. The last named has become very abundant around Honolulu. A small *Scymnus* was found quite numerous upon the Coccid on *Salicornia* and was sent to the Islands; it resembles *S. guttulatus,* Lec., which is found abundantly on *Adenostoma fasciculatum* and *Baccharis pillularis,* infested with Lecanium; it was sent to the Islands in large numbers some thirteen years since.

In Arizona and Sonora a number of useful ladybirds were found and forwarded. A common weed, *Ambrosia artemisiaefolia* was found here and there to be badly infested with a Coccid, *Dactylopius* sp., often in such masses as to almost obscure the upper part of the plant. On this large numbers of *Hyperaspis lateralis,* Muls., were present in all stages, and several consignments were made of this Coccid with large numbers of the *Hyperaspis* which—as Mr. Craw has been informed by letter —is badly attacked by a Chalcid parasite. This scale is also attacked by an internal parasite, which was sent, and may prove of value in the Islands. The same *Hyperaspis,* described under a number of specific names, was also kindly forwarded by Mr. Ehrhorn from San Francisco; and from Alameda, California, specimens were collected on *Adenostoma fasciculatum* infested with *Lecanium* and *Pulvinaria,* during the autumn in 1893. The trees in the parks at the City of Mexico are badly attacked by a Coccid (*Dactylopiid*) upon which a variety of this ladybird is found. At times it is seen in large numbers and at other times but rarely, when the largest part of the pupae are destroyed by a Chalcid parasite. Sendings from this locality were made at various times, to the Commissioner of Agriculture and during 1902 to Dr. Perkins.

Another species of *Hyperaspis* was found during spring in Arizona, breeding upon a Coccid infesting *Opuntia;* the same was forwarded in all stages on its original food.

Whenever *Quercus undulata,* which grows sparingly over the hills around Nogales, Arizona, was found to be infested by *Aspidiotus personatus,* Comst., *Chilochorus cacti,* Linn., was always present and breeding on the same. Specimens of this, as on previous occasions, were also sent. Another species was found upon the same oak tree, or rather more so on the variety *crisea,* Emgelm., breeding upon a species of *Kermes.* Some of this ladybird, *Exochomus pilatei,* Muls., were also sent. Another interesting Coccinellid that was sent is *Thalassa montezuma,* Muls.; on one occasion this was found in large numbers in larva and pupa state upon a mesquite tree, *Prosopis julifera,* feeding upon a large Lecaniid, *Toumeyella mirabilis,* Cock. This fact had previously been reported by the late Mr. H. S. Hubbard in the Proceedings of the Entomological Society of Washington,

Vol. IV, No. 3, p. 297. I have met with this insect in abundance on a similar, if not the same Coccid, upon *Acacia greggii* and *A. farnesiana,* at Cuautla, Morelos, Mexico, July, 1897. My notes do not show whether I sent the insect at that time.

During 1897 I collected a Coccinellid, of the Exoplectrae group, feeding upon an *Icerya,* in the State of Morelos, Mexico, and had then been informed by Mr. Schwarz that it was a species of *Chnoodes.* These are South American insects, a few species only have been taken in Mexico. In southern Arizona, *Icerya rileyi* was found upon several species of Mimosa, including mesquite, *Prosopis juliflora.* It is often riddled with holes from which a *Chalcid* parasite has issued, and the latter was bred in large numbers. This is apparently a useful enemy and may with advantage be used against *I. purchasei.* A species of ladybird, similar to that found in Morelos, was also present in considerable numbers and breeding upon *I. rileyi* around Nogales and Benson, Arizona. I also had the larva of the same, from which four *Chalcid* parasites were bred. I consider this of sufficient importance to record, since this parasite may readily be imported, or appear on its own account, in any district where the *Vedalia cardinalis* has been introduced, upon the larva of which it would unquestionably breed and prevent its beneficial work. Should this ever be the case—and it may be expected at any time in southern California—we should have recourse to the deadly *Chalcid* parasite of *Icerya rileyi,* which even without the help of man, may find its way into the orchards of southern California, if it is not already present.

## OTHER BENEFICIAL INSECTS.

Of other useful insects found and forwarded in large numbers is *Calosoma simplex,* Lec. If the establishment of the same on the Islands should be successful, this would be a valuable agent in reducing the countless numbers of the so-called cut worms. I have had ample opportunities to observe the habits of these beetles. Being more or less nocturnal insects, they are attracted to the light during the evening in large numbers, where, amongst the hosts of various other creatures similarly attracted, they can gratify their insatiable appetite. Hardly any insect, that

may sit around on the ground, is safe from their attacks.* Small moths are usually an easy prey, even the numerous lively crickets are often attacked and after a few rough tumbles are overcome, any injured and helpless moth, however large, is devoured by them. Often some of these beetles would run over the walls full of resting *Sphingidae;* and it was repeatedly observed that this *Calosoma* would deliberately fasten its mandibles into, even such a large moth as *Protoparce 5-maculata,* Haworth, when both would fall to the ground and become separated again; yet undaunted, the beetle will renew its attack.

*Calosoma scrutator,* Fabr., was observed both in larva and mature stages. During spring, when the willow and cottonwood trees are covered with the larva of *Malacosoma,* the beetle and its larva are active by day and night under dead leaves at the base of the tree, always in wait for any larva that may come down to pupate. The beetle at this time can be seen at almost any time during the day, often ascending the trees in quest of larvae or cocoons of the above moth. I have fed them on the pupae and the usual meal consisted of some six or more. One of this *Calosoma* was kept in confinement for over three months (at which time it had to be killed on account of my departure) usually burying itself in the ground and becoming partly dormant, if food was not forthcoming, yet always becoming active again after devouring a few larvae of *Agrotis,* upon which it had been fed.

On a hot sunny day, June 17, 1906, while walking over a grass field in Sonoma County, California, a large coleopterous larva was noticed on top of the grass, exposed to the rays of the sun and with its head buried in a cocoon of one of the numerous *Malacosoma* present; it fed a few days longer on the same, entered the ground in a glass jar wherein it had been placed, and pupated. It produced the beetle twelve days later, yet remained in the ground a week longer; when it was taken out, it proved to be *Calosoma discors,* Lec.

A nocturnal tiger beetle, *Tetracha carolina,* Linn., or variety thereof, previously sent from Mexico, was also amongst the consignments.

## THE HORN FLY.

Further enemies of the Horn fly (*Haematobia serrata*) were collected during the year and forwarded to Mr. Craw, mostly by means of puparia and maggots of flies that breed within manure, and produce internal parasites. More of the manure beetles were sent from Arizona and Sonora; of these I should expect the best results from a species of *Pinotus* (sent previously from the States of Morelos Mexico, with a host of other species found in that locality) which with *Canthon* and *Copris* comprised the sendings.

In Europe the value of Histerids as enemies of the Horn fly has long been recognized and a considerable number of the same were sent, some two or more species. What appears to be the larva of the large forms in Arizona was often present in considerable numbers in dung droppings of a few days old or in the ground below the same, at a time when the maggots are most abundant. These larvae were sent to be bred.

The mature beetle appears shortly after the manure is dropped, and may be found anywhere within or beneath the same, where it deposits its eggs. Within a week's time full grown larvae are already present, often in such numbers as to destroy every single maggot, not within the manure alone, but also in the soil, since repeated and careful examination of the ground to a depth of some five inches failed to reveal either maggots or puparia, though there were always plenty of these *Hister* larvae in search of those maggots, that had entered ground for pupation. Some two dozen of these larvae will take care of the entire lot of the various species of fly maggots that may breed in one dung dropping. I refer only to those larvae sent to breed. When full grown they construct a rather hard roundish cocoon out of earth, from two to five inches below the surface, and pupate herein.

I did not find time to breed the mature insect from this larva, yet so much material has been sent, that it should be an easy matter to do so in your laboratory, and we should not fail to establish this beetle on the Islands, providing the conditions are suitable.

Besides this *Hister,* two or more species of Carabidae, *Anisodactylus* sp., were most always present under manure that had become partly dry, so that the maggots therein had begun to

leave the same and enter the ground. Most of these beetles were found burrowing in the soil at that depth where the fly maggots usually pupate, and it was but rarely that any puparia of the flies could be found, where this beetle was present.

In addition to the above predaceous insects there is another important agent in helping to keep the Horn fly in check. This is a small red ant, met with over large areas of ground; whenever present, and probably some sixty per cent. of the dung droppings will disclose the same, this ant will destroy every solitary insect that may breed in the manure; the ground below to any depth that the maggots may descend, is found swarming with it, and few, if any, of the puparia are exempt from destruction. This ant was not introduced, since the same conditions prevail on the Islands where *Pheidole megacephala* is so abundantly represented. With all the numerous enemies preying upon the Horn fly (there are many not enumerated here, for example the numerous Staphylinidae, and the internal parasites, which escape observation in the fields), the Horn fly is more or less a pest during a few months of the hot summer weather in California, Arizona and Sonora.

Respectfully,

A. KOEBELE.

# DIVISION OF ANIMAL INDUSTRY.

## Report for the Year Ending Dec. 31, 1906.

By Victor A. Norgaard, V. S. (Copenhagen).

*Superintendent of Animal Industry, Board of Agriculture and Forestry, Territory of Hawaii.*

*Veterinary Inspector U. S. Bureau of Animal Industry.*

The Board of Commissioners of Agriculture and Forestry,
Honolulu, Territory of Hawaii.

Gentlemen:—

I beg to submit herewith my second annual report as Superintendent of Animal Industry and Territorial Veterinarian.

Under the various headings below will be found such information as may be of interest to the breeders of different classes of live stock, in some cases supplemented by private or official correspondence pertaining thereto.

Very respectfully,
VICTOR A. NORGAARD,
Territorial Veterinarian.

## INSPECTION OF IMPORTED LIVE STOCK.

During the past year the following live stock arrived on board sixty-three steam or sailing vessels:

| | Honolulu. | Hilo. |
|---|---|---|
| Mules | 178 | 117 |
| Horses | 97 | 9 |
| Bulls | 71 | |
| Milch cows | 52 | |
| Calves | 25 | 2 |
| Hogs (for slaughter) | 3344 | |
| Hogs (for breeding) | 15 | |
| Sheep (for breeding) | 33 | |
| Goats (Angora) | 18 | 12 |
| Dogs | 22 | 3 |
| Crates of poultry | 125 | 4 |

The regulations governing the importation of live stock, which were approved by the Governor on September 11th, 1905, have proved effective, and I am pleased to announce that the local representative of the United States Bureau of Animal Industry in San Francisco has signified his willingness to inspect all stock intended for shipment to these Islands. This, however, does not include the testing of horses and cattle for glanders and tuberculosis, and importers of these two classes of animals are still referred to this Board's inspector in San Francisco, in case they prefer to have them tested before shipment. The principal value of having Government inspection in San Francisco will, however, consist in the prevention of shipment of obviously affected animals, for instance cholera hogs or hogs originating from infected districts..

The appended correspondence relative to this subject will undoubtedly prove of interest to all importers of hogs.

Honolulu, April 5, 1906.

Dr. A. D. Melvin,

Chief, Bureau of Animal Industry, Washington, D. C.

Sir:—

On March 25th the bark "R. P. Rithet" arrived in this port with ninety-two hogs on board, many of which showed decided symptoms of hog cholera. The bark had left San Francisco on February 19th, and had, therefore, been thirty-four days on its way, during which time 158 hogs out of a total consignment of 250 head had died. These hogs had not been inspected in San Francisco before leaving, even though the owner had received repeated instructions from me not to ship hogs to this port without first having them inspected by Dr. Baker. It appears from statements made by the man who accompanied the hogs, and from other persons on board, that the animals were sick when placed on board on February 17th, two days before the bark sailed. During the first five days out the 250 animals ate less than 100 lbs. of feed, and on the sixth day several of them were reported to have broken out with large sores on various parts of the body. On the eighth

day they began dying and continued so all during the voyage, eleven head being thrown overboard the morning of the day when they arrived in Honolulu. The hogs were sold by R., B. & Co. of San Francisco, and were consigned to Messrs. W. & C. of this city.

I immediately took steps to have several of the pens in the Animal Quarantine Station, near Honolulu, made hog proof, and, the morning after arrival, the animals were unloaded directly into stock cars and taken by rail to the quarantine station. Six head had died during the night on board and four more died on the way to the station. A post-mortem examination of these ten hogs showed the typical pathological alterations of hog cholera and swine plague. I had the apparently well ones separated from those which showed symptoms of the disease, and commenced treating them with the hog cholera remedy recommended by the Bureau. Since then about twenty head have died, on all of which I have made post-mortems with the same result as above described. The remaining animals will be confined at the quarantine station until they have either died or recovered, and will in no case be allowed to be taken to the fattening pens connected with the slaughter house, where hundreds of hogs are constantly being kept, but will in due time be taken in wagons to the slaughter house and killed, subject to post-mortem inspection.

As there can be no doubt that the animals in question were affected with hog cholera and swine plague when they were placed on board in San Francisco, I would like to ask what, in your opinion, should be done to prevent a recurrence of this incident. A regulation promulgated by the Board of Agriculture of this Territory prohibiting the importation of hogs without a certificate of health from the Bureau of Animal Industry Inspector at San Francisco, or other ports, would hardly be sufficient. Stock is constantly arriving here which has been submitted neither to the test of mallein or tuberculin, nor to any other inspection, and, considering the long voyage, the expense of shipment and the cost of the animals imported, it has not been found advisable so far to prohibit the landing of animals, even though they arrive here without certificates. In my opinion an order from the Bureau of

Animal Industry forbidding the shipment of live stock to this Territory without inspection would be far more effective, and the Territorial Board of Agriculture and Forestry would very much appreciate such action on the part of the Bureau. There is to my knowledge but little hog cholera or swine plague in the Territory, and great loss would be caused if a virulent form of the disease gets in here. The principal importers of live hogs in this Territory always buy their hogs in California, from districts which are known to be free from the disease in question, and avoid, as far as possible, to have them unloaded in San Francisco, except directly on board the ship which is to carry them to this port. This precaution was omitted in this case with the result that the importers suffered heavy loss. Please inform me whether the firm in question can have any recourse against the San Francisco firm for selling them diseased hogs, and whether any regulations of the Bureau of Animal Industry regarding shipment of stock in interstate trade have been violated. I have taken every precaution possible to prevent the spread of the disease here, but I realize that it might have been wiser to have immediately killed the remnant of the shipment which arrived here alive.

Very respectfully,

(S) V. A. NORGAARD,
Inspector.

Rooms 407-8, Post Office Bldg., San Francisco, Cal.,
Oct. 24, 1906.

Dr. Victor A. Norgaard, Territorial Veterinarian,
Honolulu, Hawaiian Islands.

Dear Doctor:—

Will you kindly notify me of any shipments of live stock received from this port unaccompanied by certificates from this office.

The conditions here have been such during the last few

months that it has been impossible to keep close watch on such shipments, or to receive ready communication from the transportation companies. Conditions here are righting themselves now, and it is thoroughly possible to handle these shipments as they should be, and I wish to get the transportation companies into line prior to the issuance of Regulations under the new Law, No. 340.

If you will kindly do as requested it will assist me very materially in accomplishing this object.

Trusting you are enjoying good health, and assuring you of my very high regard, and thanking you for any action taken, I am,

Yours very truly,

(S) GEO. S. BAKER,
Inspector in Charge.

Honolulu, Nov. 5th, 1906.

Dr. Geo. S. Baker, Inspector in Charge, Bureau of Animal Industry, San Francisco, Cal.

Dear Doctor:—

I beg to acknowledge receipt of your letter of the 24th ult. requesting that I notify you of any shipments of live stock received at this port from San Francisco unaccompanied by certificates of health issued by your office.

In reply I would say that I shall be pleased to cooperate with you in the establishment and enforcement of any rules or regulations which may tend to prevent the shipment of infected or diseased live stock to this Territory.

I do not know what you meau by the new law, No. 340, to which you refer in your letter, but would be glad to have you send me a copy of the same at your earliest convenience.

While I have been in charge at this port diseased live stock has arrived here three times. In two shipments of horses and mules glanders was present or developed shortly after

arrival here, and in one shipment of 250 hogs only 90 arrived here alive, and 40 of these died subsequently from hog cholera.

From the enclosed local regulations you will notice that I have made the mallein and tuberculin tests compulsory for horse stock and cattle before admission to this Territory, and I have been contemplating issuing a regulation for the inspection of hogs at San Francisco before shipment to this port. Such inspection should embrace a careful enquiry into the origin of the hogs, and would require a thorough knowledge on the part of the Inspector as to the various districts in California where hog cholera now prevails or has recently prevailed. Any hogs originating from one of the infected districts or which have been exposed to the infection in transit, should be refused a certificate of health until they have been kept in quarantine for three weeks.

The S. S. "Enterprise," of the Matson line, which left San Francisco about two weeks ago, arrived here this morning with the following live stock on board: 9 cows with 6 small calves; 1 bull; 2 hogs; 2 horses, and 5 crates of chickens. None of these were accompanied by any certificate from your office, and as the cows and horses had not been tested in San Francisco, they will be kept in provisional quarantine here until the tests have been applied to them.

Kindly advise me whether you think it necessary for me to issue the contemplated regulation regarding the inspection of hogs before shipment to this Territory, or if I may count on these animals being inspected by you prior to shipment.

With kind regards, I remain,

Very sincerely yours,

(S) V. A. NORGAARD,

Territorial Veterinarian.

Rooms 407-8 Post Office Bldg., San Francisco, Cal.,

November 24, 1906.

Dear Doctor:—

Replying to yours of the 5th inst., I beg to say we are making on the S. S. "Nevadan" hence today, the following shipment of live stock for your port:

Two horses presenting strong suspicion of glanders; 10 mules which have been associating with the horses for the past week, and are consequently exposed. These are consigned by W. H. M. of San Francisco to the C. S., Honolulu, and shipment is being permitted simply for the reason that we haven't' authority to refuse shipment. They are being shipped, however, without a certificate, a permit being issued to the captain to enable him to clear his vessel without the certificate. The consignor was advised to submit these animals to a mallein test and was told that if same stood the test a certificate would be issued. He said, however, he would prefer taking his chances and have the test made at your end.

There are, in addition, 8 mules consigned to the H. M. L. Co., Hilo. These are apparently free from disease and are being so certified. The Inspector has instructions to see that these 8 mules are placed entirely apart from the other 10, so as to avoid exposure on the way down, if possible.

There are 1 boar and 3 sow pigs being shipped in a crate, for breeding purposes.

There are 17 cows, 2 of which were rejected on account of enlarged sub-maxillary glands and the consequent suspicion of tuberculosis; 1 Holstein cow with a sucking calf; 1 bull originating at Mountain View, California, and for which the shipper has a letter from the breeder, G. B. R., claiming the bull has been submitted to the tuberculin test, but no chart appears; 247 hogs, fat, from the northern portion of the State —Ukiah and Willits—and apparently in first class condition.

There has been no cholera in that vicinity to my knowledge for two years.

So far as your issuing a regulation for inspection of hogs at this point, before shipment to Honolulu, is concerned, it would strengthen our hands here if such a regulation were issued and called for inspection by an officer of this Bureau.

I have taken this matter up with the State Veterinarian of California, and have asked him to cooperate to the extent of keeping me posted continually as to appearance of hog cholera in any portion of the State. If such a regulation is issued. as you propose, and the State authorities are willing to co-

operate, I will agree to have pens, corrals, and cars thoroughly cleaned and disinfected, in which shipments of hogs are handled.

In regard to the stock which left here on the steamer "E." of the "M." line, they called me up and told me that they had five crates of chickens and several dogs which they desired to ship, and asked if such were subject to inspection by this Bureau. I told them "no," and evidently they have stretched my "no" to cover the stock you mention.

You state that you are enclosing some local regulations calling for a mallein and tuberculin test, but you failed to enclose the same. I would be glad if you would send me any such.

I will be very pleased indeed to do anything in my power to assist in the work, and can guarantee a careful inspection at this point prior to shipment.

With very kind regard, I am,

Yours very sincerely,

(S) GEO. S. BAKER,
Inspector in Charge.

Honolulu, T. H., December 29th, 1906.

Dr. George S. Baker, Inspector in Charge of the Bureau of Animal Industry, Post Office Bldg., San Francisco, Cal.

Dear Doctor:—

Your letter of the 24th ult. relating to a shipment of live stock on the steamship "Nevadan" received, and I would say that I am very much obliged to you for the timely information contained in your letter.

The two horses which you stated were suspicious of glanders had apparently recovered when they arrived here, but were nevertheless placed in quarantine and subjected to the mallein test. Neither of them re-acted.

The two cows, however, were undoubtedly tuberculous, but

I have been unable so far to test them as they are expected to calve very shortly. They are, however, kept in quarantine, and if they re-act will be destroyed.

Acting on your suggestion I have prepared a regulation for the inspection of hogs at San Francisco before shipment to this point, and the same will be promulgated as soon as submitted to the Board and approved by the Governor.

I am very much afraid of getting virulent hog cholera in here, as it would undoubtedly cause a very great loss. It has been here three or four times before and each time came close to cleaning up all of the hogs in the Islands.

I enclose copies of the local regulations, which I forgot to send in my last letter, and would add that the Board of Agriculture was very much pleased with the interest you have taken in the matter of inspecting stock for this Territory.

Again thanking you, I remain,

Very sincerely yours,

(S) V. A. NORGAARD,
Territorial Veterinarian.

As already stated in my report for last year, glanders appeared among a shipment of mules from San Francisco, one case developing shortly after arrival here (January 8th, 1906). Every precaution was immediately taken to prevent further spread, and so far as I have been able to ascertain, none of the remaining animals became affected.

A limited number only of the horses and mules which have arrived here during the past year have been accompanied by certificates of Mallein test, and have, therefore, been kept in provisional quarantine until tested. This method is far from satisfactory, as it is not always easy to identify a mule from even a careful description of the same, and arrangements have, therefore, been made for the tagging in the ear of all animals until tested. The same will apply to horses and cattle.

During the past year there has been imported 71 head of bulls, principally Herefords and Shorthorns, and nearly all registered animals. This is very encouraging, as this num-

ber greatly exceeds that of the preceding year, and continued importations of such high class breeding stock can only prove a blessing to every meat-eating person in the Territory who will sooner or later partake.

The milch cows, on the other hand, have with few exceptions been only medium to fair grades, and it seems strange how it pays to import that class of stock.

A new industry in the live stock line has been inaugurated by one of the larger ranches, by the importation of a number of pure bred Angora goats. As there are undoubtedly vast stretches of land in the Islands eminently adapted for these frugal and hardy animals it is to be hoped that the experiment will prove a success.

The importation of live hogs for slaughter has increased over last year by nearly 1,000 head, or a total of 3,358. Out of this number sixteen (16) were imported for breeding purposes, and of these only five (5) were pure bred animals. This does not compare favorably with the increased importations of other classes of breeding stock, and I can only repeat my statement in last year's report that I feel more convinced than ever that the Territory is well adapted for the raising of hogs, and that I trust before long to see this branch of the live stock industry take a great swing up.

A total of thirty-three sheep were imported for breeding purposes (as compared with 63 the past year). Thirty of the former were, however, ewes, pure bred Shropshires, and as these will be placed with the best imported rams in the Islands, they will form the nucleus for a herd of pure bred Shropshires, island bred, which, in my opinion, is very much to be desired.

The Metropolitan Meat Company, Limited, of Honolulu, imported during the past year the following frozen mutton:

| | | Weight. | Value. |
|---|---|---|---|
| 4970 | Australian Sheep .... | 196,904 lbs. | $19,015.84 |
| 1687 | California Sheep .. .. | 81,474 lbs. | 8,404.84 |
| 6657 | | 278,378 lbs. | $27,420.68 |

One hundred and twenty-five crates of poultry arrived here during the past year. The aggregate number of individual birds would probably exceed 3,000. A great variety of fancy birds were received, and I have no doubt that the recent poultry show has given a great stimulus to this long neglected industry. The majority of the birds seem to stand the long trip very well and arrive here in good condition, even though frequently shipped in very cramped quarters. One game cock which arrived here recently from Manila was destroyed in accordance with a Federal order which forbids the introduction of any live animals into the United States from the Philippine Islands.

## IMPORTATION OF STOCK FROM NEW ZEALAND.

The following correspondence will indicate what action has been taken by this office in order to obtain permission for the importation of stock from New Zealand. It is to be hoped that the Federal Government will be able to see its way clear to comply with the desire of the stock breeders in this matter:

Jan. 31, 1906.

Dr. A. D. Melvin, Chief, Bureau of Animal Industry,
Washington, D. C.

Sir:—

I have been asked by the Directors of two of the largest ranches here regarding the possibility of having live stock, especially cattle and sheep, allowed to enter this Territory from New Zealand and Australia.

Several of the ranch owners are of the opinion that stock imported from either one of these places would do better here than stock from the United States. Only the best breeding stock would be selected, and an expert from this place would be sent to New Zealand or Australia to select animals and bring them here. There are still strains of early importations of stock from New Zealand left here, and they seem, according to the observations of their owners, to have carried

down the characteristics of their breeds to a greater extent than importations from the States.

I may add that either of the ranches are in a position to isolate this stock after its arrival here, and that the prolonged stay on board ship might be considered at least a preliminary quarantine.

If, on account of ticks, importations from Australia should be absolutely prohibited, would you allow cattle or sheep, in small numbers and for breeding purposes only, to be imported from New Zealand?

I would also like to ask whether dogs can be brought to the United States from either Australia or New Zealand without restrictions.

Yours respectfully,

(S) V. A. NORGAARD,
Inspector.

United States Department of Agriculture, Bureau of Animal Industry, Washington, D. C.

Dr. V. A. Norgaard, Honolulu, Hawaii.

Sir:—

Referring to your letter of the 31st ultimo, concerning the importation of breeding stock from Australia and New Zealand, I have to advise you that the official reports from these countries show that contagious pleuro-pneumonia (lung plague of cattle) exists in Australia, and that there is a contagious pleuro-pneumonia of lambs in New Zealand. This Bureau, therefore, is not favorable to the importation of live stock from either Australia or New Zealand to Hawaii.

Regarding the importation of dogs, please find enclosed Biological Survey Circular No. 30. Dogs should receive careful inspection by yourself or other qualified veterinary inspectors upon arrival.

Very respectfully,

(S) A. D. MELVIN,
Chief of Bureau.

Honolulu, T. H., December 29th, 1906.

Dr. A. D. Melvin, Chief of the Bureau of Animal Industry,
Washington, D. C.

Sir:—

I would again call your attention to the desire of the local live stock breeders to obtain stock from New Zealand for breeding purposes. In your letter of February 26th, 1906, you state that the official reports from New Zealand show that there exists a contagious pleuro-pneumonia of lambs in that country, and that consequently the Bureau was not favorable to the importation of live stock from that source. I subsequently wrote to Dr. J. A. Gilruth, Chief Veterinarian of the Department of Agriculture, of New Zealand, asking for further information regarding the sheep disease in question and received in reply a letter containing the following information:

"As regards importing cattle and sheep from New Zealand, I am sure you need not be in the slightest degree afraid of the introduction of any disease. With regard to contagious pneumonia with pleurisy, due to a diplococcus, we have had no further cases of this, and considering that all sheep slaughtered for export are examined by departmental officials, I am certain that if such disease had been present in any district we would have gotten track of it. Pleuro-pneumonia in sheep was only recorded by me as an interesting condition; it has never spread from one farm to another, and the two outbreaks reported only affected a very small percentage of the sheep on the farms. I would further add that a considerable number of stud sheep are sent annually from this colony to the Argentine and to Australia, and I have never heard of any complaint regarding the health of our stock in either of those countries. All live stock exported from here are carefully examined before being shipped, which, of course, is an additional precaution."

From the above and from more recent official reports it would appear that there is little to fear from any introduction of disease with stud sheep or cattle from New Zealand, and as the breeders here fully believe that live stock from that colony

thrive better here than those from the States, it would be much appreciated if the Bureau could see its way clear to allow the importation of a limited number of sheep or cattle.

Very respectfully,

(S) V. A. NORGAARD.
Inspector.

## DISEASES AMONG LIVE STOCK IN THE TERRITORY.

### GLANDERS.

Most prominent among the infectious diseases, which have come under observation during the past fiscal year, is undoubtedly Glanders. Forty-four cases have been brought to my notice and have been destroyed, and I have little doubt that as many again have died without being reported. At a low estimate this disease alone has cost the Territory $10,000 during the past year.

Of the cases reported seventeen occurred in Honolulu, twelve on Oahu, outside of Honolulu, and fifteen on Maui.

Considerable difficulty has again been experienced in dealing with live stock owners of Oriental origin. The following letter addressed by me to the Honolulu agents for a certain rice company will illustrate a single case:

Honolulu, October 25th, 1906.

Gentlemen:—

In regard to the recent outbreak of glanders among the horses belonging to the ..... Rice Company at M., Dr. Fitzgerald, Assistant Territorial Veterinarian, went out and found one horse suffering from glanders. This animal was removed to the animal quarantine station in Kalihi, where, upon the return of the writer from Hawaii, it was destroyed. The post-mortem examination fully demonstrated the correctness of the diagnosis and samples of the affected organs are now on exhibition in this office. It was also learned from this examination that the animal in question must have been affected for a long time before the same was reported to this

## ADDENDUM.

After this report had gone to print the following communication was received from the Chief of the Bureau of Animal Industry, under date of February 13th, 1907:

"In view of your statements concerning the importation of sheep and cattle from New Zealand to Hawaii, on account of the bette adaptability of these animals for that locality than those from the States, a limited number of such breeding animals may be imported from New Zealand to the Islands, subject to the provisions of B. A. I. Order 109, copy herewith enclosed."

Applications for permit to import cattle or sheep from New Zealand to this Territorry should be addressed to the Territorial Veterinarian.

I called again the next morning and found an English speaking Chinese in charge, with whose assistance I selected the animals to be tested, and that same evening twelve horses were injected with Mallein. The following morning when Dr. Fitzgerald reported to take the temperatures the same hostile feeling prevailed; nobody would lend a hand and only impertinence could be elicited in reply to inquiries for the bookkeeper. It, therefore, became necessary to return to Honolulu and secure assistance for the handling of the animals. The early morning temperatures and the nine o'clock temperatures could not be taken and the test of these twelve animals cannot be considered satisfactory as far as it pertains to the animals which gave no reaction. The 11:30 a. m. temperature, however, revealed the following condition: Of the twelve animals injected six showed no diagnostic rise in temperature, while the six others showed temperatures ranging between 104 deg. and 106 deg. F. As neither of the latter had any elevation of temperature before injection it must be considered that they have reacted typically to the test, or, in other words, there is a very strong probability that they are infected with the glanders bacillus.

On the following Saturday the remaining eleven horses were injected, the test being finished at 1 p. m., October 21st. The result showed five animals to have given typical reaction to the test, while six showed no appreciable rise in temperature.

Between the first and second test one horse was destroyed by the owners. As this animal had given strong reaction and showed no external symptoms of glanders, it is much to be regretted that such action was taken without notifying this office, as a post-mortem examination might have thrown considerable light on the conditions on the premises in question.

From the above investigation I feel justified in drawing the following conclusions, upon which further action will be based:

Glanders has prevailed on the plantation of the Rice Company at M. for some considerable time—at least for several months. As no precautions have been taken to prevent the spread of the disease, it stands to reason that some of the other animals which have come in constant contact with the affected ones have become infected. That such is the case has been fully demonstrated by the Mallein test.

The owners have shown a spirit antagonistic to the laws of the country and defiant towards its officers. Under these circumstances I would feel justified in destroying all of the animals which have reacted to the Mallein test and to place the entire plantation under strict quarantine for an indefinite period, and unless I can obtain a satisfactory guaranty that efforts on my part to relieve the situation, as far as it can be done under the present regulations, will not be abused by the owners, I have no other alternative.

The lines along which I would proceed in dealing with the present situation would be as follows:

(1) A strict separation of all of the suspected animals from those which have not reacted, the former under no circumstances to come in contact with any other horses, mules or asses, whether belonging to the same company or not. This would mean that in no case shall any of the suspects leave the premises of the Company in question.

(2) Separate watering troughs, stable utensils, harness,

halters, etc., must be provided for each set of animals and in no case interchanged.

(3) Outside horse stock shall not be allowed to enter the premises, fields or other property belonging to the said Company and located in M.

(4) The suspected animals must be branded or marked in such a way as to be easily recognized and identified.

(5) All of the animals belonging to the Company in question shall be subject to regular inspection by the Territorial Veterinarian, or his representatives, and every assistance rendered by the said Company in making such inspections.

(6) Rule 3 of the Division of Animal Industry, T. H., shall be translated and explained to the owners.

Very respectfully,

(S) V. A. NORGAARD,
Territorial Veterinarian.

The following letter addressed to the Territorial Board of Health will explain the further action taken in the matter:

The Honorable, the President of the Board of Health,
Honolulu, T. H.

Sir:—

Pursuant to our conversation of yesterday I beg herewith to request the cooperation of the Board of Health in the eradication of glanders among horse stock in Honolulu.

That this dangerous disease, which is transmissible to man, and always with fatal result, prevails here to an alarming extent has been fully demonstrated, more than sixty cases having been destroyed by me during the past year.

In attempting to eradicate this disease it is of the utmost importance that the premises where affected animals are found be thoroughly disinfected after the latter have been removed to quarantine or destroyed, and it is in regard to this part of the work that I would especially solicit your cooperation.

The glanders bacillus will persist in water troughs and

mangers, or on stable utensils, halters or harness for a considerable time after being discharged by an affected animal, and unless a thorough and scientific disinfection can be effected the danger of repeated outbreaks from the same source will remain.

As this office is utterly unprovided with means for carrying out such work I have been compelled hitherto to rely on private enterprise, more or less experienced and more or less reliable, and I have found in a number of cases that the work performed has been ineffective.

At the present time I am dealing with an outbreak of glanders among the horses belonging to the ..... Rice Company at M. There are two stables, with several yards, accomodating about twenty-four horses. Two horses have been destroyed and of the remaining twenty-two, ten have given typical reaction to the Mallein test for glanders.

These, however, will not be destroyed until they show physical symptoms of the disease. They will, however, be branded and placed in strict quarantine, separated from the uninfected horses on the premises until the rice harvest and planting has been finished.

If, therefore, your Honorable Board decides to cooperate with this office, as suggested above, I would ask that the disinfection of the premises in question be undertaken on Sunday, October 28th, at 8 a. m., when I shall be present myself with my assistant.

In anticipation of a favorabie answer, I beg to remain,

Yours respectfully,

(S) V. A. NORGAARD,
Territorial Veterinarian.

Honolulu, November 5th, 1906.

C. S. Holloway, Esq., Superintendent of Public Works,
Honolulu, T. H.

Dear Sir:—

I beg to make application for the registration of a brand for

official use only, consisting of the two letters T and V, connected at the top, as follows: TV.

This brand will be used only on animals suspected of suffering from either glanders or tuberculosis; that is, animals which have reacted either to the Mallein or the Tuberculin tests, and which are being kept in provisional quarantine pending the definite establishment of the diagnosis.

The brand will be applied to both sides of rump and the police authorities will be requested to arrest any person leading, driving or being in charge of any animal so branded, when found outside of the premises on which such animal has been quarantined, unless said person has previously obtained and can produce a written permit from the Territorial Veterinarian authorizing the transfer of such animal from one place to another.

Very respectfully,

(S) V. A. NORGAARD,
Territorial Veterinarian.

Another case was reported from Manoa Valley A Japanese owned a horse which apparently was badly affected with glanders and farcy. The Assistant Territorial Veterinarian was despatched to the place, but no trace could be found of either the Japanese or the horse. The owner had noticed that the horse was attracting attention and no doubt thought it was time for him to make himself scarce.

This same condition is, however, not peculiar to this country, although the remedy therefor is the same everywhere; that is, the Government to pay a reasonable compensation for the destruction of diseased animals, when the case is reported by the owner.

I have before me a "Special Report on Glanders," by Hon. J. G. Rutherford, Veterinary Director-General of the Department of Agriculture of Canada, and dated Ottawa, September 1st, 1906. The same has just come to hand, and in support of the above theory, I beg to quote therefrom as follows:

"Although the time which has elapsed since the inauguration of the policy of compensation and slaughter is altogether too

short to enable us to form a definite and decided opinion as to its wisdom and probable effectiveness in securing the eradication of glanders, the following figures furnish convincing proof that it has a strong tendency to remove the disinclination generally evinced by owners to report outbreaks of the disease and to permit the slaughter of their horses.

| | | Tested. | Re-acted. | Killed. | Clinical. |
|---|---|---|---|---|---|
| | 1902-3 | 1,062 | 466 | 219 | 219 |
| | 1903-4 | 1,387 | 420 | 499 | 499 |
| Inclusive of Manitoba | 1904-5 | 4,899 | 1,854 | 2,113 | 932 |
| | 1905-6 | 3,957 | 1,285 | 1,387 | 561 |
| | (To March 31) | | | | |
| | 1906-7 | 4,200 | 850 | 946 | 502 |
| | (To Aug. 31st) | | | | |
| | Total | 15,505 | 4,875 | 5,164 | 2,713 |

"In considering these figures I desire particularly to draw your attention to the large increase, not only in the numbers of those tested and killed as reactors, but of those showing clinical symptoms. These figures furnish incontestible evidence that the present system brings to light a very large number of cases of glanders, which, without provision for payment of compensation, would never have been reported.

"Under the conditions formerly existing, there was a tendency on the part of owners and doubtless of some veterinarians, to avoid trouble and loss by concealing the existence of glanders. Where no compensation is paid many owners, otherwise quite respectable, are undoubtedly in the habit of allowing clinically affected cases to run their course, working them as long as possible, and finally either permitting them to die or having them quietly destroyed; while those less honest or more unprincipled have no hesitation in subjecting them to palliative treatment, with a view to removing or concealing suspicious symptoms, and subsequently disposing of them to the best advantage.

"I am satisfied that the system now followed in Canada will, by removing temptation, prove effective in overcoming, at

least to a very large extent, these tendencies shown by depraved human nature under less favorable circumstances."

Mr. Rutherford strongly advises the testing with Mallein of all animals which have come in contact with an affected animal, whether showing clinical symptoms or not, and the destruction of the same if they react typically to the test. This, however, can only be done where compensation is paid. In support of this he says:

"The figures already quoted from the returns of the Board of Agriculture of Great Britain indicate that, under modern conditions, the disease, unless properly controlled, is certain to spread rapidly and to cause a constantly increasing loss in horse flesh.

"As an illustration of this, I would quote from our own experience the case of one Canadian lumber company in a remote part of the country which reported last year, for the first time, the existence of glanders among its horses. Inquiry elicited the fact that in less than four years upwards of fifty head of valuable horses owned by this company had died of glanders. Of thirty-six survivors, thirty-four reacted to Mallein and were destroyed. Of the two remaining, neither had been in contact with the diseased horses.

"We have a number of similar cases on record, but it would scarcely be possible to furnish a better illustration of the evil results certain to follow carelessness or neglect in dealing with glanders.

"In this connection I cannot refrain from quoting an extract from the London 'Lancet,' of July 5th, 1905, which in a review of the report of the Board of Agriculture speaks as follows:

" 'Glanders is admittedly on the increase, and it is time that some radical measures were taken to control the disease. In 1894 there were only 502 outbreaks reported but in 1904 these had increased to 1,539, and 2,658 horses were killed as glandered. More power ought certainly to be given to the veterinary inspectors to test the in-contact horses with Mallein, as by this agent an almost infallible diagnosis can be made within twenty-four, or at most, forty-eight hours. The

expense, although great the first year, would not be excessive if allowed to spread over a period of years; and where a preventible disease, which also causes the death of numbers of human beings each year, is concerned, the cost ought certainly not to be considered too seriously as the reason why it should not be taken thoroughly in hand!'

"He further says:

" 'When engaged in private practice, however, I had an opportunity of forming an opinion on the subject, for although, after the use of Mallein was adopted, which, with me, was in the year 1893, I invariably advised my clients to destroy all typical reactors; the law did not make their slaughter compulsory and many were permitted to live. Not a few subsequent outbreaks of which I was cognizant were undoubtedly due to the retention and distribution of infection by these apparently healthtly animals."

In regard to the value of the Mallein test in the eradication of glanders he says:

"Again, I would remind you of the days before Mallein was heard of, when in spite of all our efforts and precautions, case after case and outbreak after outbreak, of glanders would occur in the same stable. After each fresh outbreak the most thorough disinfection was practiced, and all the surviving horses subjected to careful scrutiny and continued close observation. Six months, or perhaps a year, would elapse and then anotl er case or series of cases would occur. We blamed the stables, we thought the contagion, or, as we then called it, the virus, was immortal and indestructible. Now we know that, outside of the animal body, the life of the bacillus Mallei is, under the most favorable conditions, limited to three or four months. In the animal body it is a different matter, and the cause of the mysterious recurrent outbreaks was the chronic latent case of glanders, then unrecognized, but now, through the agency of Mallein, marked down and known as a reactor."

I have taken the liberty of quoting Mr. Rutherford at length as he is a well known authority on glanders, and I have little doubt that now that the Department of Agriculture of Canada has obtained sufficient money to pay compensation for all

animals destroyed, he will succeed in eradicating glanders from the Dominion.

I am further of the opinion that glanders prevails here to a proportionately greater extent than it does in Canada, but that, owing to the limited area of this Territory, it should be a comparatively easy matter to check and gradually eradicate the disease, if sufficient funds for this purpose should be appropriated.

The following letter refers to the above mentioned importation of mules, among which glanders developed after arrival here:

February 13th, 1906.

Dr. W. F. Egan,

1115-1117 Golden Gate Avenue,

San Francisco, Cal.

Dear Doctor:

I regret to inform you that one of the mules tested by you under date of December 23rd, 1905, developed symptoms of what at first appeared to be strangles, which later developed into typical glanders, necessitating the destruction of the animal a few days ago.

The animal was noticed to be sick shortly after its arrival here, with swelling of the left sub-maxillary glands, but the attending veterinaraian did not consider it of much importance. However, the animal continued to carry its head stiffly and kept separate from the other mules. A week later it developed a typical discharge from the left nostril, and when I first saw it, on February 4th, it had typical ulcerations on the left side of the septum. The mule was destroyed on February 10th, having been previously tested with Mallein and giving a reaction at the thirteenth hour of 104.8. On post-mortem the ulcerations on the left side of the septum were found to be nearly penetrating and extending over an area of 1 x 3 inches on the lower third of the septum with another large ulceration, about an inch in diameter, on the turbinated bone, with a smaller ulceration on the septum opposite it; the left

sub-maxillary gland had attained a size of about 1 x 3 inches and was adherent to the skin. In the lungs were hundreds of small but typical glander nodules.

As a result of this I felt constrained to quarantine the ten mules of the same shipment, which were still in the possession of the importer, Mr. L. M., and to notify the various plantations which purchased mules from this shipment warning them to watch the same and to keep them separate from other animals on the plantations.

The mules in question, including the one which developed glanders, have not been in contact with any other animals since their arrival here, nor has the disease been known to exist in or in the neighborhood of the enclosure where they have been kept.

You will remember that one mule of this shipment, No. 36, developed a rise in temperature of 3.5 degrees when tested by you in San Francisco, and was not shipped. I am, therefore, inclined to believe that the animal which I destroyed here had the infection in its system before shipment, but not sufficiently developed to cause a reaction when tested by you. This will explain the telegram which Mr. M. sent to you a few days ago and the reply to which he has shown me today.

In reference to the two mares which you tested for Mr. I. and refused to issue permit for, I have learned that he has had them shipped on a sailing vessel and that they will arrive here in the course of next week. Mr. I. has shown me a number of certificates issued by local veterinarians in California who have examined the mares physically and stated that to the best of their knowledge neither of the animals were affected with glanders. Mr. I. has also shown me the records of the two tests made by you, and from which I judge that there was no other course left open for you than to refuse to issue the permit. I shall place the mares in question in quarantine immediately upon their arrival, and submit them to a Mallein test as soon as they have recovered from the trip. I shall notify you of the results of said test.

It is, of course, unfortunate that this case of glanders should

develop among practically the first shipment of mules which were tested in San Francisco, but I have explained to the Board of Agriculture the conditions under which the said test was made, stating that I have had similar experiences myself in testing wild mules, and the Board is satisfied that every reasonable precaution has been taken in order to prevent the introduction of the disease to this Territory.

Very respectfully,

(S) V. A. NORGAARD,
Territorial Veterinarian.

## OSTEOMALACEA.

As stated in my report of last year, this disease prevails to a considerable extent in several of the islands, and causes considerable loss among nearly all classes of livestock, in preventing the growth and rapid maturity of the food producing animals.

The treatment inaugurated by me in feeding bonemeal on certain ranches where the deficiency in lime salts is apparent, has been continued throughout the year, and with very satisfactory results. Where the treatment has been carried out systematically the mortality resulting from this disease has practically come to a stop, and a very noticeable improvement has resulted in the growth and development of the young animals which have been born in pastures supplied with bonemeal. On one of the large ranches on Hawaii from five to seven tons of bonemeal has been distributed every month, and it stands to reason that this rather expensive treatment or process would not have been continued except actual benefit therefrom was apparent. It is now contemplated to extend this treatment to every part of the ranch, where it is deemed necessary, which will probably necessitate the use of some fifteen tons of bonemeal per month and the constant employment of three four-mule wagons.

The use of molasses in connection with this treatment has been practically abandoned, and the bonemeal has been simply

mixed with equal proportions of coarse salt. It was found that the cattle ate this mixture very freely as soon as they realized the presence of the bonemeal in the salt, and as there is no danger of the mixture fermenting, as was the case with the molasses, and as the cost of transportation has been considerably reduced, the salt and bonemeal mixture must be considered a decided improvement.

On the Molokai Ranch bonemeal and molasses has been fed to a considerable extent during the past year, and has, in the opinion of the manager, served to make the stock winter, or pass through the dry season, in better condition than has heretofore been the case.

A letter from the manager of the ranch in question is herewith appended:

Molokai Ranch, October 30th, 1906.

Dr. V. A. Norgaard,
Territorial Veterinarian, Honolulu, T. H.

Dear Sir:

My first experiment, following your recommendations, with feeding bonemeal to stock was made in the wet season, when feed was fresh and green, and the bonemeal was then mixed with salt, and the stock failed to take it. I had then two hundred four-months-old lambs weaned on to a field of rape, off which they were being shipped to market in small lots, and weighing out, when dressed, on an average of from 25 lbs. upwards, and I have no doubt if they had taken to the bonemeal and salt mixture placed before them, they would have done even better. The very dry weather in February temporarily wilted the rape and the lambs had to be turned out on a large pasture, and further experiment with them postponed.

After that I tried mixing the bonemeal with molasses, and the stock did not take to it for some time; in fact not till the feed got dry, when some began to eat it and the rest quickly followed, and then the difficulty arose of keeping only such stock as needed it on the pastures where it was fed, as the

large stock would eat such quantities of it. With sheep and lambs this was not difficult, as small enclosures could be made on their pastures accessible to them alone, and the troughs filled with the mixture kept in these.

I found this system of feeding bonemeal of great value in the case of choice pure or half-bred young stock; these were kept on small pastures where the feed was very dry and they were fed all the bonemeal and molasses, mixed thick, that they cared to eat, and this with a ration of kiawe beans kept them in fine condition through the driest months. It was also fed to two-year-old bulls and mules, and mares and suckling mules with good effect.

When the dry ranches have so far advanced as to cure a quantity of hay every year, so that in exceptionally dry seasons they will have a reserve of feed to carry, at any rate their best stock through, and in any dry season I think the bonemeal will be of great value to feed with the hay, chaff or ensilage, especially if these animals can be paddocked in the algeroba belt where they can also pick up some beans. Lambs and young wethers, I believe, could thus be profitably fattened for the market in the dry season, as they can be fattened with rape or other fodder crops in the wet months.

I have demonstrated on the Molokai Ranch the possibility of growing fine crops of rape, and of growing and curing heavy crops of Rhodes grass hay, and have laid plans for raising and storing hay in quantity as a reserve for dry years.

I think that your discovery of the lack of lime salts in the Hawaiian grasses, and this being greatly the cause of the slow growth of stock on the Islands, is a very important and valuable one, as it would not matter how much we developed fodders and grasses, this lack would always be in them, and we have now been shown how to counteract this; and I am sure that on the Molokai Ranch feeding bonemeal has very greatly assisted in carrying some of the best stock in such good condition up to this time.

Yours very truly,

(S) G. C. MUNRO,

Manager Molokai Ranch.

## OSTEOPOROSIS, OR BIG HEAD, IN HORSES.

This disease has during the past year been noticed in a number of localities, and one distinct epidemic, which has resulted in the loss of a number of valuable animals, has occurred on one of the plantations on the Island of Oahu.

The outbreak on Maui described in my last report, has apparently subsided under the lime-water and bonemeal treatment, but up to the present writing I regret to state that no noticeable benefit has been observed therefrom in the Oahu outbreak.

On the plantation in question cases of Osteoporosis have occurred in only one stable out of three, the feed being identically the same in all the stables. The iodide of potassium treatment has been tried in individual cases but apparently without success.

I would, therefore, urgently recommend that the Division of Animal Industry be placed in a position to investigate this disease thoroughly, and that means be provided for experimenting on affected animals. On one plantation alone more than one thousand dollars' worth of stock has been lost during the past year, and as the disease is more or less prevalent throughout the Territory, it would seem that the establishment of an experimental laboratory would be a good investment.

The following letter concerning some cases of this disease on the Island of Maui is of interest:

United States Department of Agriculture, Bureau of Animal Industry, Washington, D. C., July 28, 1905.

Dr. Victor A. Norgaard, Honolulu, T. H.

Dear Sir:

I am in receipt of your letter of the 21st ult. relative to your trip to Maui, and asking for suggestions as to the treatment of an outbreak of osteoporosis among the horses belonging to the ..... Company, of Paia, Maui.

In reply I would say that there is no specific treatment for osteoporosis, and the disease is in many cases extremely re-

fractory to all medication. A complete change of surroundings to a higher or lower altitude, and especially to a limestone district, if practicable, has often resulted in producing a complete cure. In case it is necessary for the animals to remain in their present location an entire change of diet is to be recommended. At the same time calcium phosphate in 1½ to 3 dram doses, or ground bonemeal in 1 to 2 tabelspoonful doses in the feed two or three times daily is beneficial. Pure phosphorus may also be given in ¼ grain doses, three times daily, in the form of pills with cacao butter. The affected animals should be given plenty of lime water to drink, their bowels kept loose and overloading of the gastro-intestinal tract carefully guarded against at all times.

There has been no literature published by the Bureau on this disease. Circular No. 66 treats of osteomalacia of cattle, a somewhat similar disease, and as the treatment of both conditions is practically the same, a copy of this article has been enclosed.

Very respectfully,

(S) D. E. SALMON,
Chief of Bureau.

## EMBOLIC COLIC IN HORSES AND MULES.

This disease, which is due to the local obstruction of certain blood vessels of the intestines, and is caused by the presence of a small worm which penetrates from the intestines into the blood vessels, has caused considerable loss among work animals during the past year. Two distinct outbreaks have come under observation; one on the Island of Kauai, and one on Oahu.

The worm in question (Sclerostoma armatum) inhabits the cecum and the beginning of the large colon, but is often met with in the arteries of horses and mules, and generally causes a formation of aneurisms. These verminous aneurisms are, as stated, located on the visceral branches of the posterior aorta, and average in size about that of a walnut, though sometimes they may attain the size of a man's head. They con-

sist of dilatation of the affected artery due to the presence of the worm in question. In the interior of the aneurism there is usually a fibrinous deposit, a thrombus adhering to a greater or less extent to the internal membrane of the blood vessel, which it partially blocks, but always leaving a canal in the center for the passage of blood. The worms found in these aneurisms are rose tinted, and average about half an inch in length. As a rule only a few of them are present, on an average from 9 to 11, but more than 100 have been found in a single aneurism.

The gravity of this condition is due to the risk of rupture of the vessels, and more especially to the influence on the frequency and seriousness of the colic. The clots which form in the interior of the blood vessels may throw off one or more fragments which are carried by the blood and cause obstructions in the arteries passing to the intestines, with the result that there is a sudden anaemia of that portion of the intestines to which the artery furnishes blood, and, consequently, paralysis of one or more of the sections of the digestive tube.

In consequence of this disturbance there are colics, which rapidly disappear if the obstructed artery is of small caliber. Otherwise there is stagnation and consequent fermentation of the affected part of the intestines, with an abundant production of gases. This frequently causes rupture of the intestines, the result of which is always fatal. If a verminous aneurism is ruptured the animal dies from internal hemorrhage. On the occurrence of this accident the animal crouches or sits on its hind quarters, knuckles over at the fetlock joints and seems as if struck with paralysis; the limbs become cold, and the visible mucous membranes of eye, nose and mouth become blanched. The last moments of life are marked by signs of extreme suffering.

Besides these cases of acute colic which recover in the course of twelve to twenty-four hours, and the cases of rapid death, there has been noted a more chronic course of this disease. This is characterized by a decrease in vigor of the animal, stiffness in the movements of the hind quarters, difficulty and pain in urinating, arching of the loin, swelling and

lameness of one or both hind legs, gradual but complete emaciation and death after one to six months.

The worm which causes this disease enters the intestinal canal of the affected animals by means of the drinking water, or is taken in with grass from wet pastures, where the worm is known to exist. It is, therefore, advisable when an outbreak, or even a single case of the disease is observed, to at once remove all horses and mules from such pastures. A saline purgative or calomel should be given to all of the animals, as soon as they have been stabled, and in cases of violent colics, the ordinary remedies for this disease should be prescribed. Where the animals have not been in pasture, the water supply should be carefully examined, and the only possible remedy to prevent further cases from developing would be to filter the drinking water. This can be done by means of a simple sand filter made out of a strong wooden box, with graduated layers of fine to coarse sand.

In the one outbreak on Kauai five mules have died within a short time, out of a stable of twenty head, and a number of the remaining ones are undoubtedly more or less affected. In the outbreak on Oahu the cases occurred with more or less frequency, and were undoubtedly due to the use of a certain pasture, which has now been abandoned. At the plantation in question the animals got only artesian water to drink, so this source of infection was eliminated.

I am informed of one more outbreak which occurred a few years ago on a plantation on Hawaii, where over thirty work animals were lost in the course of six weeks.

## RED WATER IN CATTLE.

This disease has not come under my personal observation, but as a number of outbreaks have occurred on both Hawaii and Maui, I append herewith some correspondence which will show the action I have taken in the matter:

Kealakekua, September, 1906.

Victor A. Norgaard, V. S.,
Honolulu.

Dear Sir:

I spoke to you a little over a year ago in regard to a disease of bloody urine among cattle in Kona, from which different ranchers are losing quite heavily every year.

The disease seems to be mostly in the forest belt, at elevations from 3,000 to 4,500 feet, and affects cattle of all kinds, except calves. In some cases animals may have it for one or two years, but usually only a few months, before they die from it. Fat animals often die sooner than those in only fair condition.

I send you per "Mauna Loa" the bladder taken from a heifer passing blood in clots. You will see there seems to be a lump in the bladder. The other intestines seemed all in good condition, and the meat was fat and seemed all right.

I trust you may be able to give us some light on the cause of this disease.

It was first noticed on the Greenwell"s and our ranches, about twelve years ago, and is now on J. A. Maguire's, R. Hind's and, I hear, at Horner's ranches.

I have been reading with interest your report in the "Hawaiian Livestock & Breeders' Association." We are losing quite largely, especially colts, from what you describe as "Osteoporosis or Big Head." The disease seems worse in the forest belt, and it is strange so, for our neighbor's stock, the Greenwell's, are not affected.

Trusting this may be of some assistance in your work, I remain,

Yours respectfully,

(S) J. D. PARIS.

Honolulu, T. H., November 9th, 1906.

Hon. J. D. Paris,
Kealakekua, Kona, Hawaii.

Dear Sir:

I regret exceedingly not having replied any sooner to your

letter which I received more than a month ago, together with a specimen of the bladder of a heifer suffering from hematuria (bloody urine). I have, however, been away from Honolulu on official business most of the time, and only returned on Tuesday last from Hawaii. This coming week I have to go to Molokai and again the following week back to Hawaii.

In regard to the disease which you describe, I am very much interested in the same and beg to say that the specimen reached me in good condition and well preserved. Upon incision the bladder was found to contain a blood clot the size of a walnut, firmly attached to the mucous membrane, which at that place was greatly thickened and showing necrotic areas.

I have hitherto been inclined to be sceptic when told that animals affected as described by you passed actual blood, and not blood colored urine, but the specimen forwarded illustrates plainly that the principal symptom of the disease in question is hemorrhage from the bladder, due to necrotic ulcers on the mucous membrane and in the muscular layers of the wall.

I remember ten years ago, while Chief of the Pathological Division in the Bureau of Animal Industry in Washington, D. C., receiving a jar full of bladders of cattle from the Island of Jamaica in the West Indies, all of which showed pathological alterations similar to those observed in the specimen forwarded by you. At the time no specific investigation was made of the disease, and as I have never since come across anything similar I am at the present time unable to furnish you any information as to the nature, cause and treatment thereof. I shall however, forward a copy of your letter to Washington and ask to be furnished with what information the Bureau may have on the subject, and will request that inquiries be made of the proper authorities in Jamaica to ascertain whether the disease has been investigated there, and if so, with what results.

In the meantime I trust that the case in question will serve to illustrate the necessity of the establishment of a pathological laboratory in connection with the office of Territorial Veterinarian, in order that I may be enabled to investigate this disease, as well as the several others of which mention was made in my report to the Hawaiian Stock Breeders' Association.

Any effort on your part in furthering this object can only serve to promote the interests of the livestock industry in this Territory.

Very respectfully,

(S) V. A. NORGAARD,
Territorial Veterinarian.

United States Department of Agriculture, Bureau of Animal Industry, Local Office.

Honolulu, T. H., November 16th, 1906.

Dr. A. D. Melvin,
Chief, Bureau of Animal Industry, Washington, D. C.

Dear Sir:

I enclose herewith copies of two letters regarding a certain form of hematuria which seems to prevail to some extent on the Islands of Hawaii and Maui.

I remember plainly the specimens which we received from Jamaica in the latter part of 1896 or the beginning of 1897 and which may possibly be found in the collection of the Pathological Division. Could you furnish me or obtain for me any information regarding this disease? It seems to me that as the disease was described to be quite prevalent in the West Indies some work may have been done on the subject during the past ten years, and anything that would throw light on the nature of the disease, and especially on its cause, would be much appreciated by the ranchmen here.

Very respectfully,

(S) V. A. NORGAARD,
Inspector.

January 14, 1907.

Dr. V. A. Nörgaard,
Inspector, B. A. I.,
Honolulu, T. H.

Sir:

Replying to your letter of November 16th, you are advised that

we are not familiar with any work that has been done in the West Indies on a disease similating the one you describe in Hawaii. It seems apparent from your description that the disease in question is a hematuria, but the cause of this condition is not so apparent. As you know hematuria may accompany many varying conditions and is in itself only a symptom, but nevertheless in bovine pathology the term has acquired a special significance. It is indicated clinically by the presence of unaltered blood in the urine, and histologically by lesions in the bladder, ureters and at times the kidneys. In Germany the disease is known as "stallroth," and in France, Galtier has given it the name of hemorrhagic cystitis. Many opinions have been advanced regarding its cause. Land reclamations and the use of lime dressings on the soil have been suggested. Destroye considers it of microbic origin and easily transmitted, but Galtier states it is produced by the consumption of irritant plants by animals affected with distomatosis. Arnold, on the other hand, attributes it to coccidiae encysted in the mucous membrane of the bladder. Boudeaud claims that hematuria affects one-tenth of all the cattle south of the Indre and north of the Creuze, where the soil is thin and poor in phosphoric acid. Knowing that the blood fluke (Bilharzia) is found in Hawaii and that hematuria is a frequent symptom of bilharziosis, it is possible that this parasite is the causative agent of this affection in Hawaii. Of course this could easily be determined by a microscopic examination of the urine for the eggs of the parasite. Hematuria may cause death by exhaustion in from six weeks to two months, but it may last for a much longer period. The animal at first passes unaltered blood, but after a time the extravasated blood coagulates in the bladder and the urine passed contains filamentous clots from the size of one's finger to that of a guinea fowl egg. When ulceration occurs, the subepithelial vessels of the mucous membrane which previously had contributed in the formation of diffused hemorrhagic patches become ruptured, allowing the flow of blood therefrom with the subsequent formation of clots. The prognosis is grave as no curative treatment is known. Prophylaxis consists in the drainage of pastures, where necessary, and their improvement by the use of fertilizers, especially superphosphates.

These alterations in the character of the soil improve the pasture and may diminish or prevent the growth of the causative agents, whether animal or vegetable parasites or irritant plants. Boudeaud has seen hematuria disappear from farms under such treatment. It has also been recommended to transfer the cattle to pastures on which the animals do not appear to be affected. The literature on this disease is slight, but general articles may be found in most of the textbooks on the practice of veterinary medicine.

Very respectfully,

A. D. MELVIN,
Chief of Bureau.

## SHEEP SCAB.

In continuation of the work inaugurated last year for the purpose of eradicating sheep scab, between fifty thousand and sixty thousand dippings have been made. A new dipping plant has been installed on the Parker Ranch, which hitherto had been considered free from this disease, but where it was noticed that a small percentage of the sheep showed small bare spots and tagging of the wool. On the Molokai Ranch all the sheep have again been dipped, and I am inclined to believe that scab has been practically eradicated, even though the horn flies continue to irritate the bare spots to a considerable extent.

The animals so affected are, however, gradually being eliminated from the flocks, and I feel confident that in the course of a few years this ranch will be able to show as clean a herd as any on the islands.

The screw-worm fly has increased considerably, several hundred cases of screw-worm maggots having been observed, but every effort has been made to eradicate this pest along the lines indicated in my report for last year. I am, as stated, of the opinion that there must be one or more powerful enemies of this parasite present in these Islands, as otherwise it is difficult to understand why the screw worm fly does not multiply to the extent which the apparently most favorable conditions here would seem to suggest.

## INFECTIOUS OPTHALMIA IN CATTLE.

There arrived in Honolulu during the past year a shipment of forty-eight bulls among which was one animal suffering from inflammation of one eye, thought to be due to an injury received during shipment. This, however, proved to be a mistake, and in the course of a few days it was found that a number of the bulls had developed infectious opthalmia. The disease gradually spread to the whole herd, affecting first one eye and then the other, and necessitated the quarantining of the entire herd for more than six months.

This disease occurs sporadically in these Islands, but does not seem to affect the native stock as seriously as it does imported stock. It yields readily to treatment and all of the cases in question recovered completely. The fact remains, however, that only one or two cases developed at the same time and that in only a few instances were both eyes affected at the same time, necessitating the above mentioned prolonged quarantine and considerable expense for treatment and care.

With the inspection now inaugurated in San Francisco it is to be hoped that no more cases will be introduced with imported stock.

## HEART WORM IN DOGS.

This disease seems to be quite prevalent here, and causes considerable loss among well bred dogs, especially of the short-haired breeds. It is transmitted from animal to animal by means of mosquitoes, as will be seen from the following letter, and no remedy has so far been discovered which will in any way alleviate the suffering of the affected animals.

United States Department of Agriculture, Bureau of Animal Industry, Washington, D. C., April 23, 1906.

Dr. V. A. Norgaard,
Inspector, Bureau of Animal Industry, Honolulu, Hawaii.

Sir:

With reference to your enquiry of March 23, as to the life

history of *Filaria immitis*, I would say that this parasite is transmitted by mosquitoes of the genus *Anopheles*.

The larvae in the circulation of the dog are sucked up by the mosquito while biting; they migrate to the malpighian tubules, then into the body cavity, and finally into the labium. these migrations and accompanying development requiring in summer about 12 days. The embryos are introduced into a new host by the mosquito during the act of blood sucking. The cuticle of the labium is ruptured and the embryo escaping immediately penetrate the skin and subcutaneous tissues until they come to a blood vessel, probably following the puncture made by the piercing stylets of the mosquito. The embryos thus introduced into a dog find their way to the heart and develop to maturity.

Very respectfully,

(S) A. D. MELVIN,
Chief of Bureau.

As it is practically impossible to keep a well bred dog here for any length of time, a thorough investigation should be undertaken in order to ascertain if some remedy could not be found for it. I have especially in mind the transfusion of blood from native, and, apparently, immune dogs, into the system of imported animals before they become infected, or at least, before the disease reaches a stage where it is beyond recovery. I would, therefore, recommend that facilities be provided for a series of experiments along these lines.

## OTHER DOG DISEASES.

The following letter, written in reply to an enquiry from the President of the Board of Health, will give some idea of the prevalence of disease among dogs in this Territory:

Honolulu, April 27, 1906.

Mr. L. E. Pinkham,
President, Board of Health, Honolulu, T. H.

Sir:

Replying to your letter of the 26th inst. I beg to say that

I am decidedly in sympathy with you in regard to a campaign against the numerous mangy and worthtless dogs which at the present time infest the streets of Honolulu and vicinity.

Of all the domesticated animals no species is the host of so many parasites, or susceptible to so many parasitic diseases, transmissible to man as well as to other species of domesticated animals, as the dog, and no other animal has the opportunities to transmit its diseases to the same extent as the dog, owing to the close companionship in which it lives with man.

I find it impossible at this time to write you fully on the subject, as I have to leave Honolulu today, but would call your attention to the sarcoptic mange of the dog, which seems to be extremely prevalent here. This disease is easily transmitted to man and epidemics of it, especially among the lower classes, have been reported from various countries. An epizooty occurred in Germany in 1890 (Berlin) where hundreds of people who had come in contact with mangy dogs were contaminated.

Another disease, common among the dogs here, is ringworm, Tinea tonsurans, which likewise is easily transmitted to man, especially to children. Favus is common among the poultry here and may be transmitted to children by means of dogs and cats.

Of more importance, however, are the intestinal parasites of the dog, particularaly the cestodes, of which the taenia echinococcus, in its cystic form, has frequently been known to cause death in man and domesticated animals. The Taenia coenurus causes a disease in sheep known as "Gid," which is common in these Islands, and one of the worst enemies of the sheep breeders.

When it is further considered that the skin of the dog is frequently infested with fleas, lice and ticks, and that the dog may infect man with one of the most dreaded and absolutely fatal diseases—rabies—then it would seem that there is every reason for limiting the number of absolutely worthless animals which now infest these Islands, and which make it nearly impossible for dog fanciers, sportsmen and others to

keep dogs for specific purposes without getting them contaminated or infected with one or more of the above mentioned diseases.

Very respectfully,

(S) VICTOR A. NORGAARD,
Territorial Veterinarian.

## EPIZOOTIC LYMPHANGITIS (Japanese Farcy).

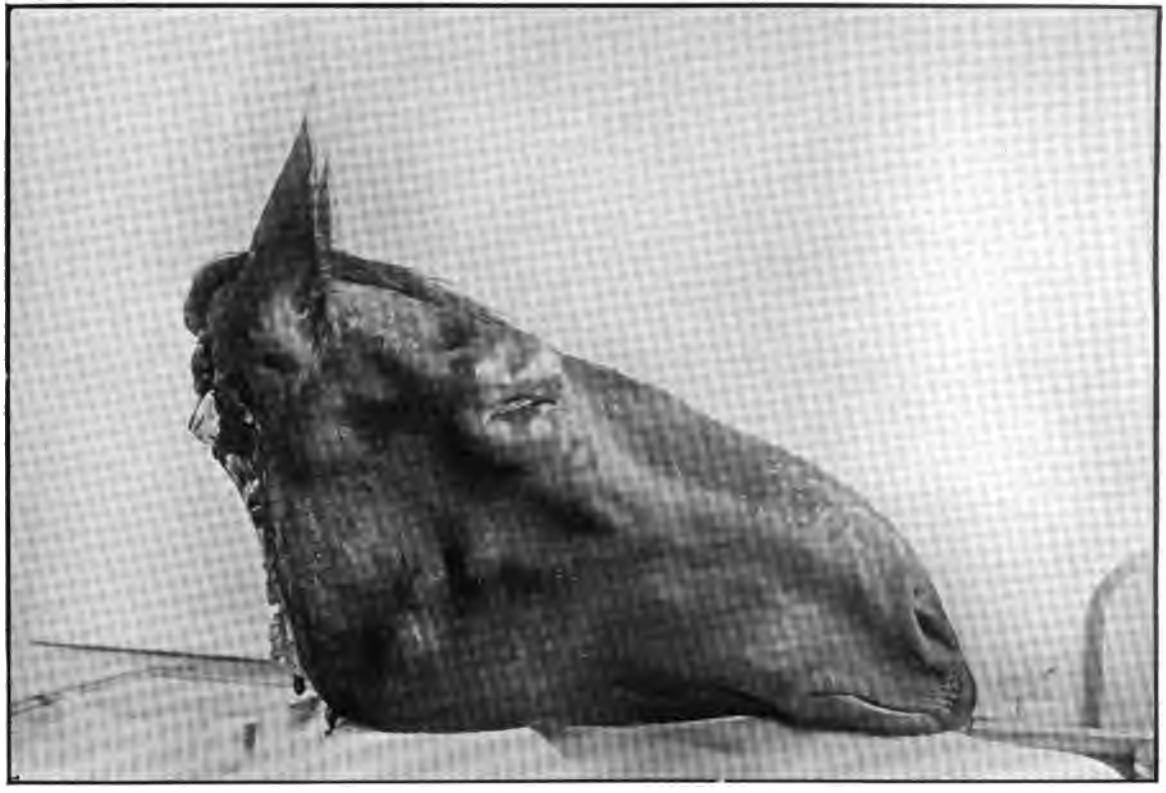
A special report on this disease is now under preparation and the same will be issued as soon as the investigation has been finished. The absolute lack of funds and facilities for laboratory investigation has delayed this important work, and unless means be forthcoming, it will be necessary to continue to deal with this diseases as has been done hitherto, that is, by immediate destruction of all affected animals, and by subsequent measures identical with those taken in cases of glanders and farcy.

Epizootic lymphangitis or Japanese farcy resembles ordinary glanders and farcy to such an extent that a differential diagnosis can only be made by means of the microscope. The disease is very common in Japan and China, but has only recently been introduced into Europe with army horses returning from South Africa. No cases have to my knowledge been reported from the mainland of the United States. In Europe the disease is dealt with as glanders, even though it is admitted that some of the cases may be cured. The disease is, however, extremely contagious, and from my experience with it here I am inclined to believe that it is more difficult of extermination than is glanders and farcy. On one plantation alone eleven valuable mules have died from this disease during the past year, and as the affected animals do not react to the mallein test incipient cases cannot be detected and disposed of until the symptoms have become manifest and the infection transmitted to other animals through the discharge from nose or running sores.

The three accompanying illustrations are from photographs of animals suffering from epizootic lymphangitis. In Plate 1 the disease had gained entrance through the right eye. The nose was not affected. In Plate 2 the infection had taken place

PLATE I

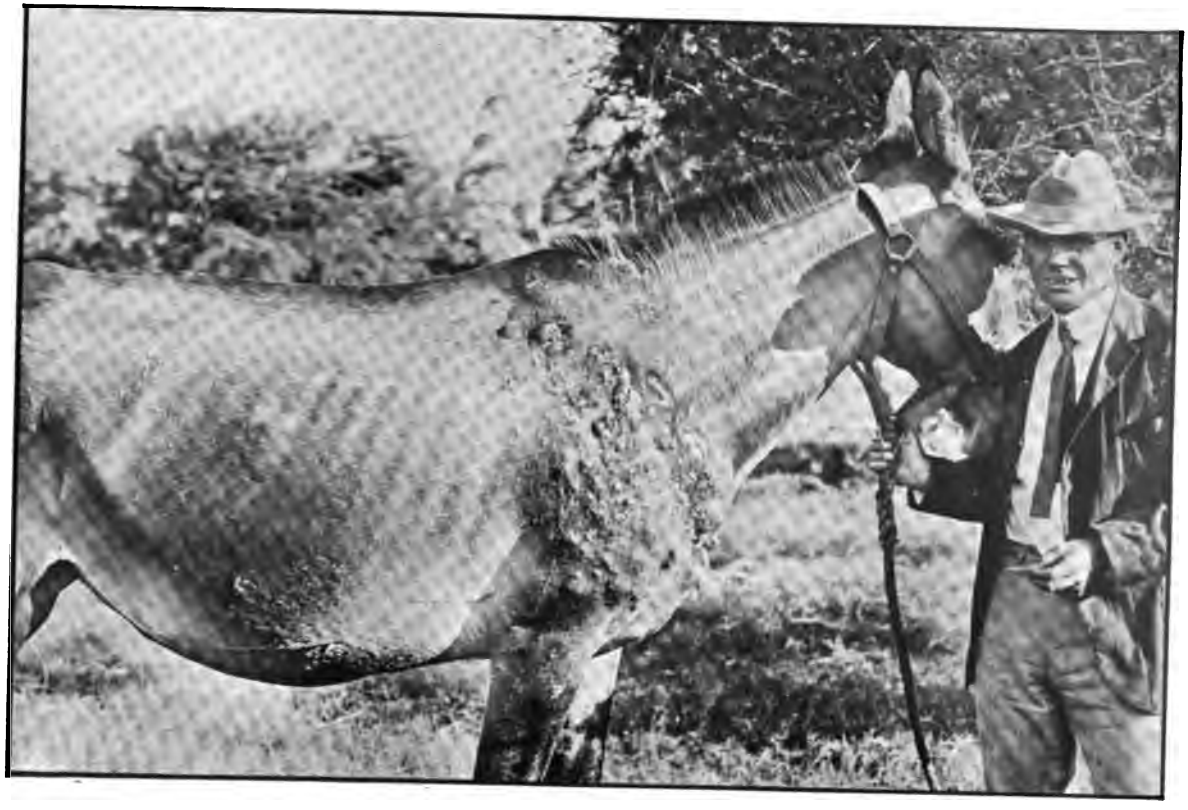
EPIZOOTIC LYMPHANGITIS IN A HORSE



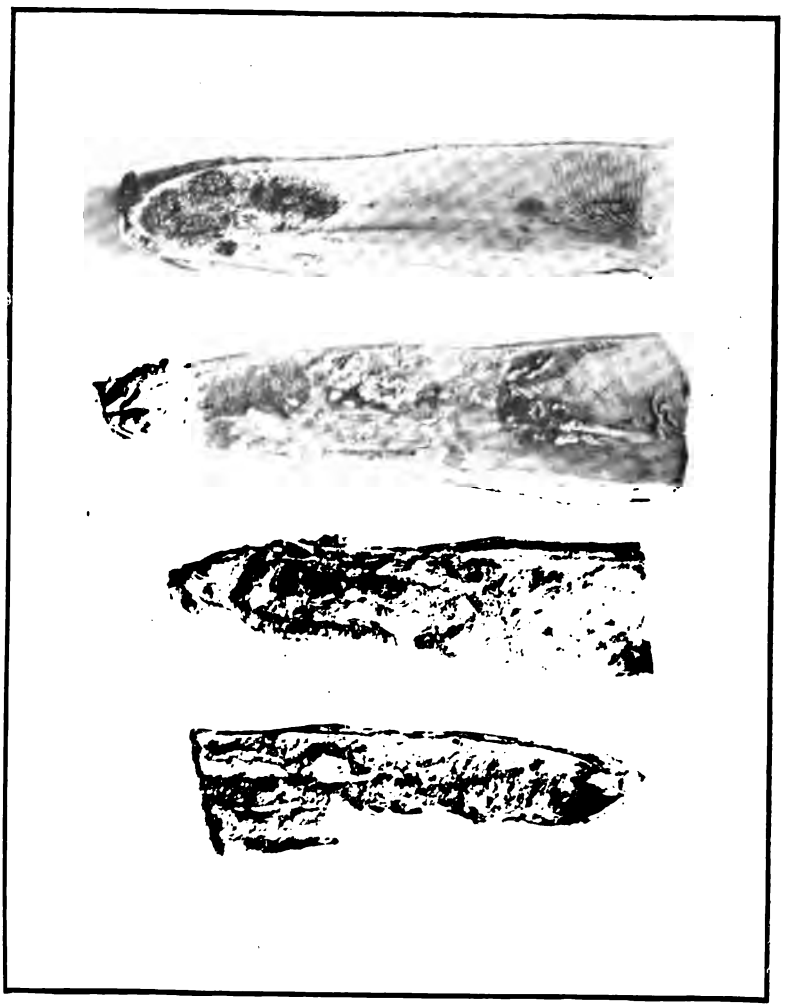
The infection has taken place in the right eye, the swelling of the eyelids and surrounding tissues completely closing the eye. From there the distended lymphatics extend toward and below the ear, and in the opposite direction halfway toward the right corner of the mouth; from there backward and down, in a zigzag line, to the lower edge of the jawbone, where they connect with the greatly enlarged submaxillary glands.

PLATE II.

EPIZOOTIC LYMPHANGITIS IN A MULE.



The infection has taken place through a harness gall on the shoulder, causing the appearance of a network of enlarged lymphatics extending from the top of the withers over the entire shoulder, the front and the lower part of the chest, the upper part of the front legs and under the chest and the abdomen. On these lymphatics appear numerous nodules up to the size of a hens egg, many of which have ruptured and are discharg-



The nasal septum (partition) from four cases of epizootic lymphangitis where the infection has taken place through the mucous membrance of the nose.

through a harness gall on the shoulder, while the remaining figures on Plate 3 show the lesions on the septum of the nose (the partition between the nostrils) where the infection has gained entrance through the air passages.

These pictures clearly illustrate the loathsome nature of this disease, and when it is stated that up to the present time the literature covering this subject is very scant, it would seem that there is every reason for making a thorough investigation here where subjects can be had at nearly any time. In order to accomplish this, however, a thoroughly equipped pathological and bacteriological laboratory must be provided and it is to be hoped that the next legislature will be able to see its way clear to appropriate the necessary funds therefor.

# DIVISION OF AGRICULTURE.

## Report of Mr. Jared G. Smith.

Honolulu, Oahu, December 31, 1906.

Board of Commissioners of
Agriculture and Forestry,
Honolulu, Oahu.

Gentlemen:—Up to December 31, 1906, the sum of $4,934.77 has been expended by me from the Territorial appropriation. This has been largely used in carrying on three lines of work: the propagation and distribution of Bluefields bananas, the cultivation of tobacco and experiments in shipping and marketing of tropical fruits.

### TOBACCO.

A report in regard to the tobacco investigations has been published for the period up to January 1, 1905, both in the Annual Report of the Board of Agriculture and in one of the press bulletins of this station.

#### SEASON OF 1905.

Early in 1905 two new cloth covered seed-houses were constructed for raising tobacco plants increasing the area of seed beds from 72 square yards to 217½ square yards. Sowings for the 1905 crop were made on November 6, 1904, November 13, December 9, January 20, January 24, February 2, February 6, 7, 10, 11, 23, 25, March 1, 10, 25, 27, April 3, 19, 24, May 8, 17, 22, June 7, 9, 17 and July 1. Seed of the following varieties were planted: Sumatra, Landreth, Glessner, Partidos, Vuelta Abajo, Comstock Spanish, Connecticut Broad-leaf, Pennsylvania Seed-leaf, Cuban from four sources, Manila, Zimmer

Spanish, Hester, Gooch, Hawaiian, Virginia Dark-leaf and White Burley.

Complete notes were kept in regard to the growth and development of all of these varieties, the object being to determine their suitability to Hawaiian conditions and establish, if possible, the best time of seeding for the Hawaiian crop. In Cuba, tobacco is a winter crop, the winter being the dry season of the year. With the exception of the Manila, none of the varieties did at all well when planted early in the winter except the Hawaiian, which grew well at all seasons of the year. Considerable information has been accumulated which will be available for publication as soon as the 1906 crop has been finished and sold. Fertilizer tests were carried on, not only in the seed beds, but after the plants were set in the field, and valuable suggestions have been obtained in regard to the requirements of the tobacco crop in Hawaii. The tobacco was set out at the rate of about ten thousand plants per acre. Two and a half acres of tobacco were cultivated during 1905 on the same leased land utilized for this crop in 1904. Tobacco-leaf was harvested from about 20% of all plants set in the field, but as the 1905 experiment was intended largely as a demonstration of the question of a suitable season of planting, the results are not surprising, and the loss no greater than was to have been expected.

Early in 1905, the old curing barn, which had a floor area of only 322 square feet with a 9-foot wall was renovated and extended into a barn of 1,280 square feet floor area with 14-foot sides and with a hanging capacity of about 1,500 poles. Better ventilation was provided than we had in the building used in 1904. A small tool room, 8 by 11 feet, a storage room 8 by 29 feet and a stringing room 8 by 12 feet were also added to the buildings. The artificial ventilators used in 1904 having been found unsatisfactory, horizontal ventilators were placed about 5 feet apart all around the curing barn. The windward side of the roof was built about 2 feet higher than the leeward side at the ridge, projecting from it far enough to protect the opening from drifting rain. The opening at the ridge was provided with a door which could be opened or closed. We secured

about one thousand new poles for handling the crop in addition to those on hand in 1904, but even the new supply was not sufficient to care for the crop.

The year 1905 was a very wet one, the rainfall being 109 inches and the harvesting months, July to October, were unusually wet with many dull cold foggy days, even when it was not raining. This made the curing of the 1905 crop a slow and difficult one and considerable trouble was experienced with stem-rot, mold and mildew. The curing process we find takes about fourteen days if the weather is good, the ventilation of the house perfect and especially if some provision is made for artificial heat in the curing barn. Without this, the curing takes ten to twelve days longer. Any one attempting the tobacco industry on a commercial scale would, of course, be provided with better facilities than we were able to acquire for our demonstration experiments.

The yield of tobacco during the 1905 season was as follows:

| | | | | | |
|---|---|---|---|---|---|
| Cuban (all kinds) | 1242 | poles | from | 5051 | plants |
| Sumatra | 504 | " | " | 5051 | " |
| Hawaiian | 1008 | " | " | 1269 | " |
| Havana | 173 | " | " | 275 | " |
| Penn. Seed-leaf | 182 | " | " | 352 | " |
| Conn. Broad-leaf | 273 | " | " | 1593 | " |
| Vuelta Abajo | 442 | " | " | 1565 | " |
| Manila | 38 | " | " | 250 | " |
| Comstock Spanish | 739 | " | " | 800 | " |
| Zimmer Spanish | 58 | " | " | 171 | " |
| Glessner | 10 | " | " | 40 | " |
| Virginia Dark-leaf | 10 | " | " | 60 | " |

The tobacco was finished as well as could be, sorted and 150 pounds of finished leaf was sold to a Seattle cigar maker with the understanding that it should be made up into cigars which would be returned to Honolulu and placed on sale. The Station received the value of the tobacco in cigars, which were distributed in Honolulu and elsewhere, in order to give people an opportunity of judging of the quality of the Hawaiian product.

## SEASON OF 1906.

In February, 1906, the lease of the Louisson lot was given up and the Land Commissioner, Hon. James W. Pratt, set aside for the use of this Station for three years, Lot No. 17, Paauilo Homesteads. It having been recognized that it would require a larger sum to carry on the tobacco experiments another season than was available from either the Territorial or Experiment Station appropriations, private subscriptions were solicited and the sum of $4,000 was advanced by five parties on the understanding that they should be reimbursed pro rata from the sales of tobacco grown in 1906 and from the sale of improvements made on Lot 17 at any time when such would be offered for sale at the close of the experimental period. The tobacco work in 1906 has cost about $6,000.00, $4,000.00 of this amount having been supplied as previously stated by private subscription, the remaining $2,000.00 from the Territorial and Experiment Station appropriations.

Four acres of land were cleared, the seed beds and curing barn were removed from the land formerly under lease and transferred to Lot 17 and lumber was purchased and a large modern curing-barn erected, capable of holding a crop from five acres of land. Operations were commenced so late in the season that it was impossibe for us to utilize the full area originally intended and while four acres were cleared and plowed, only about three and a half acres were planted, the majority of the crop being Sumatra, Havana and Comstock Spanish, the seed being mainly selections from our own plants during 1905.

The 1906 crop of tobacco is not yet completely finished. Although barn-cured, the fermenting process is not yet complete, but it has been pronounced by many experts to whom the tobacco has been submitted for examination, of as good quality as any tobacco produced anywhere in the world.

The results of the 1906 crop are such that I do not believe it will be necessary for this Station or the Board of Agriculture to attempt any further demonstration on a field scale, but

there are many points connected with the curing, fermenting and sorting, and with the treatment of the plants in the field, on which this Station could do good work, provided arrangements can be made to carry on such work in coöperation with growers. It has been demonstrated absolutely, that tobacco of good burn, texture, flavor and color, can be produced on a commercial scale and I believe at a very large profit in certain districts in Hawaii.

## BLUEFIELDS BANANAS.

The work with Bluefieds bananas, previously reported upon, has been continued during the summer of 1906. One thousand suckers were distributed to parties who applied for the same. This portion of the work is about completed as the bananas are now so widely distributed that it would not be necessary for the Station to continue their propagation on a large scale.

## FRESH FRUIT TRADE.

In August, 1906, the horticulturist of this Station took with him to California, Oregon and Washington a large shipment of pineapples, papaias, bananas and alligator pears, his object being to investigate the difficulties which have attended the Hawaiian fresh fruit trade and determine whether the obstacles were such as could be overcome.

During the three and a half months that Mr. Higgins was absent from Hawaii, he made an extensive study of market and shipping conditions on the Pacific Coast, and as a result of his experiments, the results of which will shortly be published, has, I believe, made discoveries which will prove of immediate financial value to all who have investments in this line of agricultural trade. The fresh fruit industry of Hawaii now amounts to about $100,000 per annum and even if no new markets are opened up or new outlets for Hawaiian fruits discovered, I believe that I am safe in saying that the financial results of Mr. Higgins' observations and experiments will be worth to Hawaii at least 15% of the annual value of the trade.

A demonstration has been made of the fact that papaias and

alligator pears can be shipped to the mainland without losses in transit and it is not claiming too much to state that a market for $500,000 worth of these fruits is waiting to be filled. This field is only awaiting Hawaiian enterprise to supply these fruits to an almost unlimited demand. As one result of this work, negotiations are now in progress with one of the steamship companies whose vessels trade between Hawaii and the Pacific Coast to make changes and alterations in their vessels in order better to accommodate their ships to the interests of the fresh fruit trade.

## OTHER LINES OF WORK.

In addition to the definite lines of works herein mentioned, lines which could not have been undertaken had there been no Territorial appropriation, the appropriation has proved vastly helpful to the Station through assistance rendered in the maintenance of an increased clerical and labor staff. During 1905, the Station foreman was paid entirely from the Territorial appropriation and other citizen employees have been paid from the same fund as occasion required, or as it was desirable to relieve the overburdened Station payrolls.

Respectfully,

JARED G. SMITH,
Special Agent in Charge, Hawaii Experiment Station.